SCIENTIFIC AMERICAN

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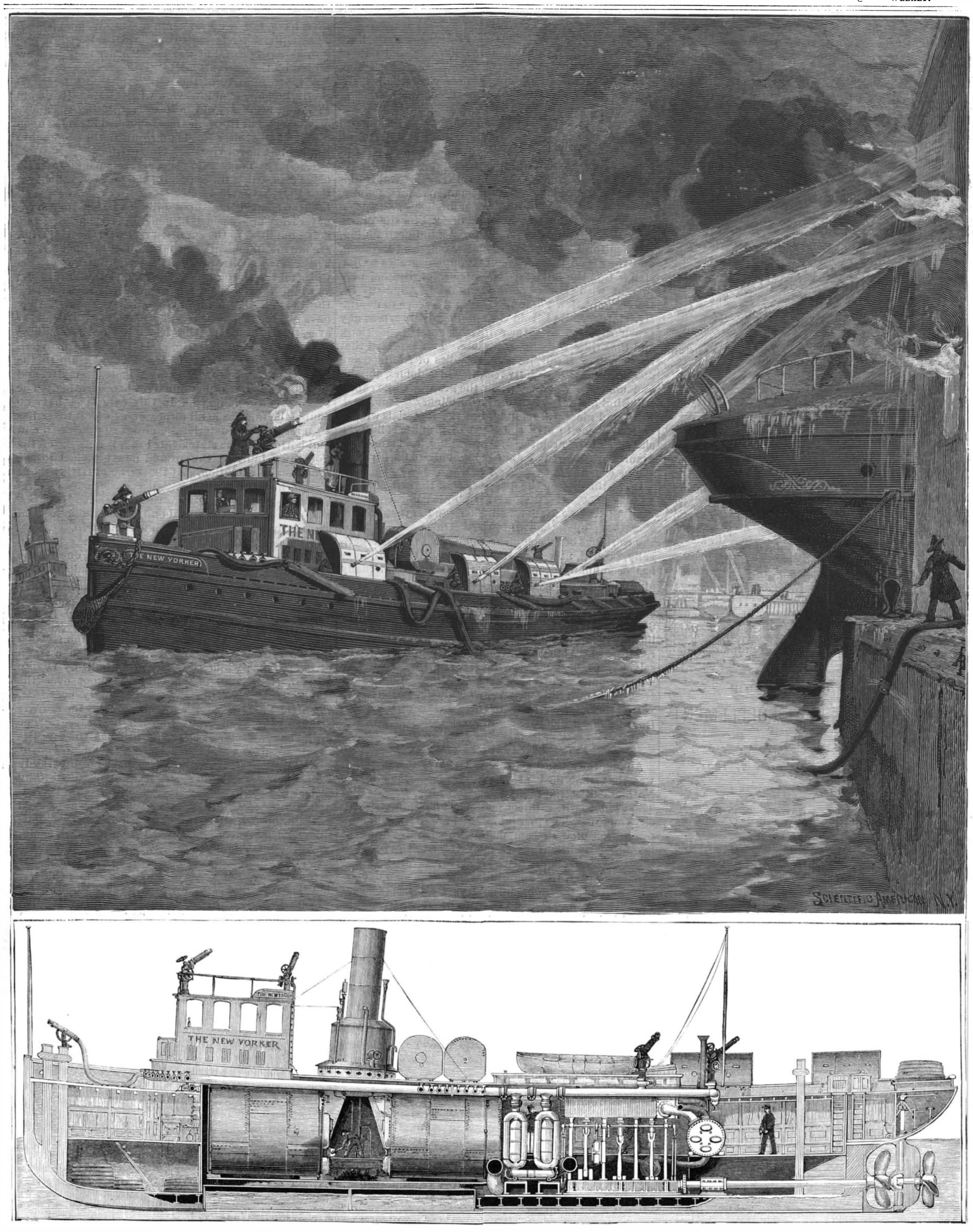

NEW FIRE BOAT FOR NEW YORK CITY—THE NEW YORKER.—[See page 148.]

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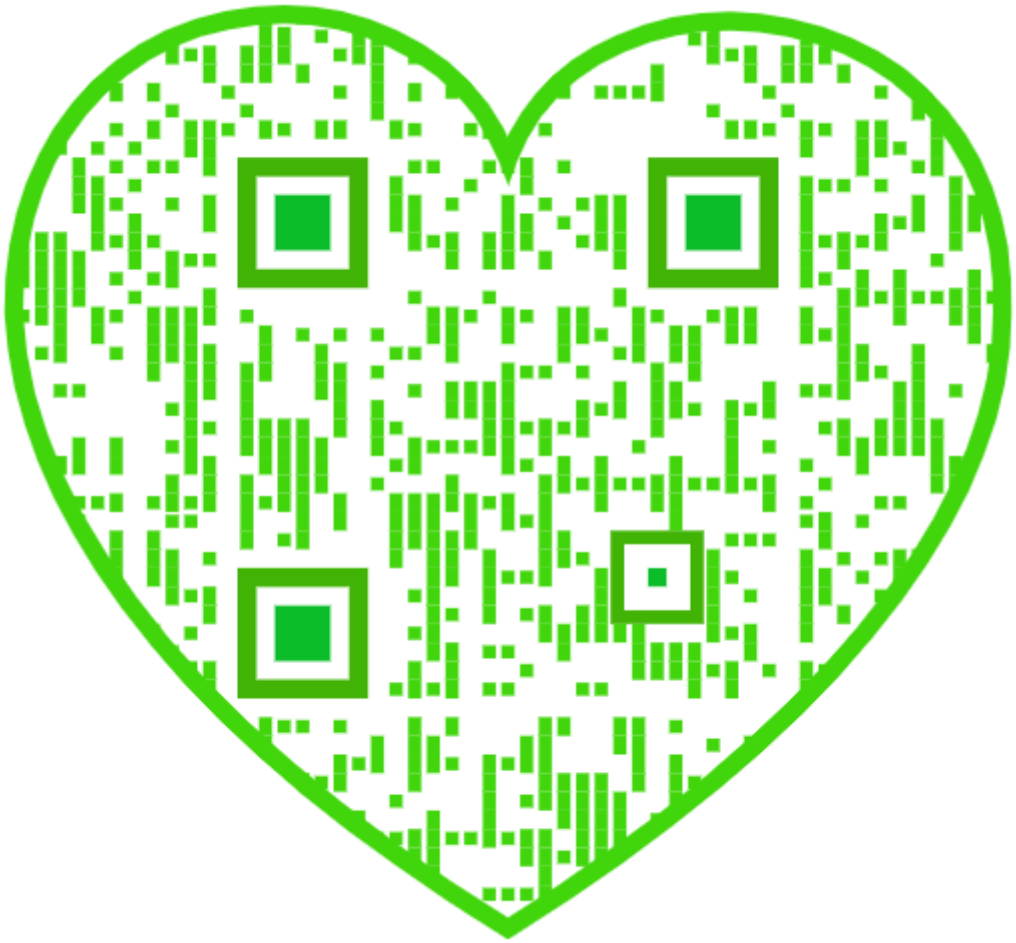

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COLUMBIAN FAIR PROGRESS.

The managers of the International Exposition to be held in Chicago in 1892–93, after many disagreements as to the site and other particulars, seem now to have come to sufficiently definite conclusions to permit of the actual commencement of work. It is decided that all the main buildings of the fair shall be at Jackson Park on the lake front, near the south end of the city, this park being connected by the Midway Plaisance with South Park, and together forming a large, unobstructed, and already improved site. The attempt to divide the fair, and put a portion of the buildings in the small but beautiful park at Lake Front, near the center of the city, has been definitely abandoned, although the latter park is to be adorned with statuary as a lounging place for tourists.

The plans for the buildings in Jackson Park have been very carefully considered by a commission of architects, which met in Chicago, February 20, and, although all details are not yet finally determined, the main features are fully laid out. Richard M. Hunt, of New York, presented three sketches for the Administration Building; George B. Post, of New York, had sketches for the Liberal Arts Building; C. F. McKim, of New York, for the Agricultural Building; R. S. Peabody, of Boston, for the Machinery Hall; Henry Van Brunt, of Kansas City, for the Electrical Building. Adler & Sullivan, S S. Beman, W. L. B. Jenney, Henry Ives Cobb, Burling & Whitehouse, the local members of the commission, had designs for the Transportation Building, the Mines and Mining Building, Horticultural Hall, Fish and Fisheries Building, and the grand entrance and triumphal arches. Olmsted & Co., the landscape architects, of Boston, were present with landscape designs, and Augustus St. Gaudens, of New York, advised in reference to decorative statuary. It is said the buildings will surpass any previously seen at former international expositions, and that they will also cost more. It is expected that there will be in all "about two miles of frontage and an average height of sixty feet, in which domes, cupolas and minarets will arise from the groups, while canals will wind about the base of the buildings." Iron, steel, brick and glass will be used, but the materials will be so treated as to give the effect of granitic solidity, a classic style of architecture prevailing, and stone and granite of different colors being imitated with marvelous exactness.

It is estimated by the directory that the expenditures will be $17,625.453, divided as follows: For construction, $12,766,890; administration and organization, $3,308,563; operation, $1,550,000. On these estimates the work has been commenced, and is to be energetically pushed, now that the location of the buildings has been finally decided upon and the plans virtually approved. The resources, believed to be available as fast as needed, are, from popular subscriptions pledged $5,000,000, from proceeds on Chicago city bonds, $5,000,000. In addition to this ten millions, it is believed there will be ultimately realized—from gate receipts, $7,000,000; from concessions, $1,000,000; from salvage, $3,000,000—or a total of $21,000,000. The members of the directory consider these estimates extremely conservative, and do not believe that there will be any further hitch in the progress of the work, from financial or other considerations.

ANOTHER FARADAY WANTED.

Among the scientific problems that await solution was that described at the recent meeting of the National Electric Light Association by Prof. Elihu Thomson, to wit, a direct method of obtaining electricity from fuel. The present method necessitates the interposition of the steam engine, in which even under favorable conditions scarce more than ten per cent of the theoretical energy of the coal is recovered in mechanical power, this suffering diminution again at the wire end of the dynamo. "It almost seems," said Prof. Thomson, "from all that we who are actively engaged in looking up matters in this connection can say, it almost seems to us that we must wait for some new discovery, for another Faraday to come forward and show us principles which are not now known, some relation between electric energy and heat energy whereby we can convert even 35 to 40 per cent—we will be satisfied with that—of the heat energy into electric energy. Look what it means, should such a thing come about. The steam engine would disappear. The steam locomotive would disappear. The steamship would be propelled no longer by the steam boiler and the burning of fuel under a steam boiler. Fuel would be burned, but burned to produce currents. The apparatus to propel the steamship would not be a steam engine with its reciprocating motions and its racking strain, but would have that quiet rotary motion which characterizes the modern electric motor."

Edison has been working on the problem. If only he could solve it! Davy, after years of unrewarded study and observation, put two wires together tipped with carbon, drew them apart and got the flame which now we call the electric arc. We put together a mechanism which has made the generation of such light commercially practicable. Faraday discovered the principle which underlies the generation of current by the dynamo, being the first to move armatures in magnetic fields. We have profited greatly also by that. If only now we could repay these free gifts by the discovery of a principle by which the energy of coal could be directly obtained!

INTERESTING NAVAL INFORMATION BY THE SECRETARY OF THE NAVY.

The impression prevails in the popular mind that there has been a falling off in the speed of our new war ships, and that they are incapable of the velocities with which they were credited on their original trial trips. It is claimed they were unduly pushed and strained on those occasions, to benefit the contractors, and neither have nor can ever again attain an equal speed. This impression has been confirmed by the slow performances of several of the vessels since they were accepted by the government.

A representative of the SCIENTIFIC AMERICAN recently had a special interview with the Hon. Benjamin F. Tracy, Secretary of the Navy, respecting the above matters, and at the same time requested his views upon the new fast cruiser No. 12; also upon the proposal to employ fast naval vessels as mail carriers.

Secretary Tracy said: "The statements recently made concerning the cruisers of the new navy, namely, that they have fallen off in speed from the records established on the measured mile, and that they have never since approached in general efficiency and seagoing qualities to the standard set up on the trial trips, are untrue statements and misleading in the extreme. These statements are particularly untrue of the Chicago, the Boston, the Atlanta, and the Yorktown; as will be seen by comparing the speeds registered by these vessels on the trial trips with the speeds they have attained on more recent cruises. It is true, however, that the cruiser Charleston has not maintained the speed of her initial trip, and on her return to San Francisco, where she is assigned as flagship to the Pacific station, I propose to investigate the matter and find out the cause of her apparent deterioration. The reason for the falling off in this case is, I have no doubt, the same as in all former cases where there has been an apparent deterioration in speed—poor coal and foul bottoms. The statement, I say, is not true of the Yorktown, built by Cramp and now attached to the squadron of evolution. At the series of trials held at Newport on August 21, 1889, her performance as regards general sea-going qualities was as good as ever, while the speed she attained on that occasion was even greater than that developed on her trial trip.

"It is not true of the Boston, which has been in commission many years, and is now also one of the squadron of evolution. She can to-day make as good speed as she has ever made. Look at the recorded speeds of the vessels of this squadron under the command of Admiral Walker, in Narragansett Bay, during the autumn of 1889. In this series of trials the Chicago registered a speed of 15·328 knots; the Boston reached a speed of 15·58 knots; the Atlanta recorded a speed of 13·45 knots; while the Yorktown, built by Cramp in 1887, showed an increase of 0·35 knot over the speed of the trial trip. Now, on ordinary occasions, there is no necessity for a quick run, and the cruisers are, accordingly, not put to their best speeds. The initial or contractor's trips show us what the vessel is capable of doing, and this is confirmed by subsequent special trials. If, then, the cruisers do not invariably maintain the maximum speed, it is not because of any inefficiency of the cruiser, but simply because there is no necessity of stretching every nerve, of using forced draught, of striving to reach a speed which we know the vessel has reached, and can at any time reach again, when the occasion calls for it. The conditions that obtain in a ship under forced draught are not conducive to the continued efficiency of the engines or machinery, and it is my opinion that no ship can be put to this great strain for any considerable time without detriment to the vessel as a whole. This maximum speed should be kept as a reserve power, in case of great emergency in warfare, and it should not be constantly exercised.

"It is in accordance with this theory that the vessels of the new navy are not, as a rule, run up to their best records. But I think it can be shown that whenever great speed is a desideratum, the vessels of the new navy are, class for class, equal to and superior to the English vessels in maintaining and retaining their initial speeds.

"The statement that the coal bunkers are of insufficient capacity is an unreasonable one. Every vessel, it has been said, is a compromise. In the designing of a vessel there are many features to be considered, and to a certain extent each must be modified by all the others. And so the speed of a cruiser must be considered in connection with the enduring capacity and with the weight of battery. As we, unlike most European powers, have no intermediate coaling stations, it is particularly essential that the vessels of our navy have a large coal capacity; indeed, in my opinion, speed and coal capacity rather than weight of battery are the important qualities to be sought for in

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a modern cruiser. It is with this end in view that the vessel now known as "Protected Cruiser No. 12" has been designed. It is expected that this cruiser when completed will be the fastest in the world and at the same time have a great coal enduring capacity. Among the things which we expect of her is to be able to steam around the world and return to her station without the necessity of once recoaling.

"She cannot, of course, owing to the lightness of her battery, take her place in battle against such vessels as the Chicago or the Yorktown. It is hoped that she will be able to overtake the fastest merchant ships and to destroy them, to remain one hundred days in the seas, and to outsail and sink any of the fast passenger steamers. All this is expected with the same fire-room conditions that prevail on the transatlantic vessels. Although this cruiser is not a fighting ship, she is nevertheless well protected, and has a coal capacity of 2000 tons, with 750 tons at normal draught. Together with the regulation coal bunkers there will be along the length and next to the side of the vessel a cofferdam in bunkers, to contain fuel which will serve as a wall, and will not be used as fuel except in a case of emergency. At the very ordinary speed of 10 knots per hour the coal capacity is such that the vessel will have an endurance of 107 days.

"The proposition to carry the United States mails in the cruisers in order to keep the engines and men up to the standard of efficiency is, so far as the purpose in view is concerned, not a bad one; but if carried into execution it would be an enormously expensive method. The great difficulty which the navy has to cope with at present is the great lack of efficient sailors. But with the improvement and development of our merchant marine it is to be hoped that we will have a more fruitful and satisfactory field for recruiting than we at present possess."

Bursting Charges for Shells.

A great many experiments have been made to determine the proper kind of powder to be used in cannon, and, as a result of these experiments, the powder used has gone through a gradual change and development, from the fine grain of early use to the large, regular grains of the present day.

Projectiles may be either solid or hollow. In the latter case they must contain a bursting charge.

While experiment has determined the best form of grain of powder to propel these projectiles, the question of the proper grain to be used as a bursting charge for shells seems to have been quite neglected.

The "Manual of Heavy Artillery, U. S. Army," by General Tidball, which is officially adopted for use in the United States army, designates musket and mortar powder as the proper powder for a bursting charge. The United States army (light) artillery tactics, speaking of a shell, says: "It is loaded with a bursting charge of rifle or musket powder, which gives great force to the fragments."

Musket and rifle powder have about 1,000,000 grains to the pound, and mortar powder about 32,000.

The reasons for selecting these powders are not given, but each authority seems to have based his statements on those of the preceding authority.

A shell may be used for two purposes, viz., demolition and against animate objects.

The proper bursting charge for the first object can easily be determined, as a shell buried and exploded would produce almost the same result as if fired from a cannon.

The proper bursting charge for use against animate objects is not as easily determined. The fragments of the shell must not be too small, or they will not disable a man, nor must they be too large, for the number of fragments being diminished, the number of possible casualties will also be diminished.

To disable a man, the fragments should not weigh less than 1 ounce, and should have a velocity of about 500 feet per second, which would be equivalent to an energy of about one-eighth of a foot ton. The velocity of the fragments is due mostly to the remaining velocity of the shell at the instant of explosion, though some of it is incidentally obtained from the bursting charge. The latter's proper function, however, is to burst the shell, since the rotation of a rifled projectile gives sufficient dispersion to the fragments.

What kind of powder, then, will burst the shell into the greatest number of fragments one ounce or but slightly greater—say between one and two ounces—in weight?

With this object in view, some experiments have been made at West Point, N. Y. The bursting pit consists of a large chamber, 5 feet in diameter and 5 feet long, made of one-half inch boiler steel. On top is a manhole and chimney, through which the projectiles, fixed with electric primers, are lowered. This manhole also gives access to the interior for the purpose of collecting any fragments of shell that may not have been removed by the tools used for that purpose, and also for repairing the pit and allowing the smoke of the explosion to escape.

At the bottom of the pit a tube, 5 feet long, gives a second access to the interior, and through it, by means of hoe-shaped tools, the fragments are removed.

Sliding plates close the manholes, so that the projectiles are fired with perfect safety, and no fragments can be lost.

To strengthen the steel chamber, a heavy granite house is built over it, and the space between the stone and the chamber is tightly packed with sand, so that it can safely be used to explode any shells and any explosive. The large size of the pit renders the conditions under which the projectile is exploded about the same as those in air.

The shells used in the experiments were the 3 inch shells, similar to the ones used in the civil war for field service.

As bursting charges were used: Mortar powder, having, as before stated, 32,000 grains to the pound; the I. K. powder, with 2,200 grains to the pound; and the E. V. powder, with 72 grains to the pound.

The results are tabulated below:

FIRST SERIES.

Weight of shell before firing....	8½ lb.	8½ lb.	8½ lb.
Kind of powder.....	E. V.	I. K.	Mortar.
Weight of fragments.....	7 lb. 14 oz.	7 lb. 8 oz.	7 lb. 6 oz.
Loss in weight.....	10 oz.	16 oz.	18 oz.
Number of fragments greater than 1 oz.....	26	22	14
Weight of fragments less than 1 oz	2 lb.	2 lb. 6 oz.	4 lb.
Number of fragments from 1-2 oz.	15	12	8
" " " " 2-4 oz.	6	5	4
" " " greater than 4 oz.....	5	5	2

SECOND SERIES.

Weight of shell before firing.....	8½ lb.	8½ lb.	8½ lb.
Kind of powder.....	E. V.	I. K.	Mortar.
Weight of fragments	8 lb. 1 oz.	7 lb. 6 oz.	7 lb.
Loss in weight.....	7 oz.	1 lb. 2 oz.	1 lb. 8 oz.
Number of fragments greater than 1 oz.....	35	23	13
Weight of fragments less than 1 oz.....	1 lb. 6 oz.	2 lb. 6 oz.	2 lb. 13 oz.
Number of fragments from 1-2 oz.	21	13	6
" " " " 2-4 oz.	6	8	2
" " " greater than 4 oz.....	8	2	5

The loss, which is principally due to a portion of the shell being reduced to dust, which could not be collected, was much less for the E. V. than for the mortar powder. As fragments less than 1 ounce are not considered dangerous, that amount of weight of the projectile is counted as loss as well as the dust. The loss for the E. V. is just one-half that of the mortar. The number of fragments between 1 and 2 ounces given by the E. V. is three times that of the mortar.

Suppose each fragment of shell greater than 1 ounce to strike and disable a man, the number of men placed *hors de combat* would be as follows:

	E. V.	I. K.	Mortar.
First series..	26	12	14
Second series.....	35	23	13

The "Ordnance Manual of 1861," and Robert's "Handbook of Artillery," 1860, which were the authorities for the United States army at the time of the civil war, designate rifle or musket powder for bursting charges. Had a powder of the E. V. grain been used, the probable effect would have been much greater.

While up to date the experiments have not been extensive enough to determine the best kind of powder for a bursting charge, still they show that the E. V. powder is much superior to the mortar, which is the kind still designated for use. The explanation for this would seem to be found in comparing the actions of the powders.

The mortar powder is much finer grained, and would be completely transformed into gas much more quickly than the E. V. Its action is much more violent, and consequently it would pulverize or reduce to fine fragments a large portion of the envelope, and so reduce the number of fragments over 1 ounce in weight. The E. V., being more progressive, would give a larger number of effective fragments. Powders finer than the mortar would pulverize the envelope still more, and larger grained powders would give a greater number of large fragments.

The theoretically perfect powder would be the one that would reduce the entire shell to fragments 1 ounce in weight. It will require many experiments to ascertain the powder that approaches nearest to the theoretical; but from the tables given above it will be seen that, of the three powders tried, the E. V. is the best for a bursting charge.

Refuge and Observatory on Mt. Blanc.

Mr. J. Vallot, a member of the French Alpine Club, succeeded last summer in erecting a permanent structure on Mt. Blanc, to be used as a refuge and observatory. Plans of a small structure best adapted for withstanding high winds were drawn, and the building was constructed at Chamounix. The house was then taken apart, and each timber was marked properly, so that the parts could be put together readily on the mountain top. One hundred guides volunteered their services to carry the parts of the building to the point fixed upon as the site. The dismantled structure was tied up into 111 loads, and the work of transportation was begun. It was a tedious undertaking carrying the heavy packages up the ascent. Three days were consumed in conveying each load to its destination. The work commenced on June 15, and on July 31 the last section of the building and the last of the ninety packages of scientific instruments had reached the site of the refuge observatory.

Six days before the last date Vallot selected five of the hardiest mountaineers as masons and carpenters, and set out for the mountain top to build the foundation. Two tents were set up for the temporary shelter of the party. The temperature was rather low for summer; the mercury dropped to 9 deg. below zero at night, and did not rise much above zero at noon. The men were clothed in regulation Esquimaux costume, with huge woolen gloves and heavy mountain caps. The style of dress was not conducive to rapid work, but the men labored vigorously from seven in the morning till seven at night. In two days the foundation was completed, and on the third the framework was in place, in spite of the persistent attempts of the wind to overthrow it. On the fourth day the last plank was nailed on the roof, and at night the workmen were able to sleep in a less windy chamber than their tent.

The work, however, was extremely exhausting in the rare atmosphere. At the end of the second day one of the men was disabled. He was given a few whiffs from the oxygen bag which Mr. Vallot had taken the precaution to include in his supplies, and recovered sufficiently to start down the mountain. The following day a second mountaineer was exhausted, and a third weakened on the third day.

Although the house was not entirely finished on the fourth day, it was thought inadvisable to remain longer on the summit, especially as the weather had become unfavorable. All hands, therefore, descended and took a brief rest.

On August 31 the party reascended the mountain, accompanied this time by Mr. Vallot's wife, an enthusiastic Alpinist. The refuge was properly braced with masonry, and the finishing touches were added. Lightning rods were put in position, after which colors were flung to the breeze to celebrate the completion of the work.

The building is divided into two apartments, one designed for the use of travelers and the other for scientific observers. The latter room is a private compartment. The public room is supplied with all the conveniences needed by the tired tourist. Nine beds are placed in the room, and a supply of provisions and of oil for light and fuel is always kept on hand. The observatory, which is said to be the highest in the world, is 14,350 feet above the sea level. It contains automatic registering devices and the most approved appliances for making scientific observations in high elevations.

Prof. Winchell.

Prof. Alexander Winchell, an eminent American geologist, died at Ann Arbor, Mich., February 19, in the 67th year of his age. He was graduated at Wesleyan College in 1847, and taught school in several places until 1854, when he was called to the chair of Physics and Civil Engineering at the University of Michigan, and a year later was transferred to that of geology, zoology, and botany, which he held until 1879. In 1866–69 he filled a similar office in connection with the University of Kentucky. Meanwhile he made a survey for a railroad from Ann Arbor to Manchester, and in 1859 was appointed director of the Geological Survey of Michigan.

This last work was practically finished when the civil war broke out, although Professor Winchell made paleontological researches in the material thus accumulated and in his publications established seven new genera and 304 new species, most of which were fossil. In 1869 the survey was renewed under his direction, but he resigned charge of it in 1871.

He accepted the chancellorship of the University of Syracuse in 1873, but at the close of that year retired from that office to become professor of geology, zoology, and botany in that same school. From 1873 to 1878 he filled a similar place in Vanderbilt University.

In 1879 he was recalled to his old place at Ann Arbor, which he filled until his death. In 1886–87 he was connected with the geological survey of Minnesota. He received the title of Doctor of Laws from Wesleyan in 1867, and last year was elected vice-president of the Geological Society of America. His name has been given to fourteen new species. By his labor he has established the Marshall group in American geology.

A NOVEL combination was recently exhibited in Chicago. A Fairbanks, Morse & Co. steam pump was driving an Erwin water motor which was coupled directly to a Thomson-Houston dynamo. The results showed economy of fuel. The advantages of such a system are first cost is less and the cost of operating is reduced. Pumps may be used for pumping water during the day and then used for light at night. It would seem that the system would be of especial application at railway stations.

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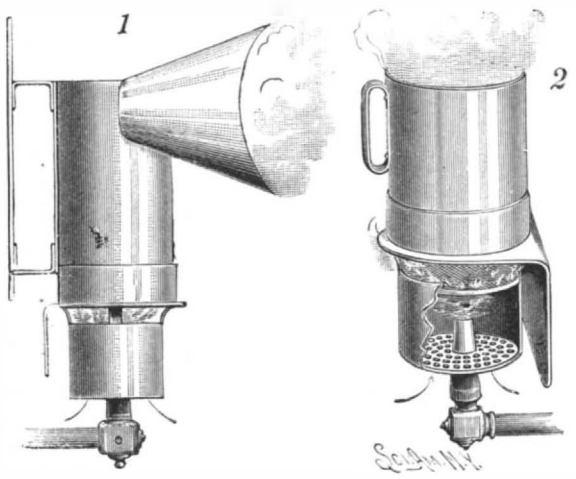
A HEATER FOR USE WITH A GAS BURNER.

The illustration represents a simple device for use in connection with a gas burner, to heat water or other liquids or food, or to heat rooms or passages. It has been patented by Mrs. Mary L. W. Martinot. The burner of the heater is of gauze or equivalent material, with a central opening to receive the gas burner, and upwardly projecting brackets support a semicircular table with a central opening, the table having a flange in contact with which rests a drum of sheet iron or other suitable material. Near the top of the drum is a side opening surrounded by a hood, adapted to direct the ascending hot air some distance out into a compartment to be heated, as shown in Fig. 1. Both the drum and the table have shields at the rear for the protection of adjacent woodwork. When the device is to be used for heating liquids, etc., the drum is removed, and a cup or other receptacle corresponding in contour to the space within the table flange is placed upon the table, as shown in Fig. 2. The device may be further supported, if desired, by attaching the upper shield to an adjacent wall or other upright.

For further information relative to this invention



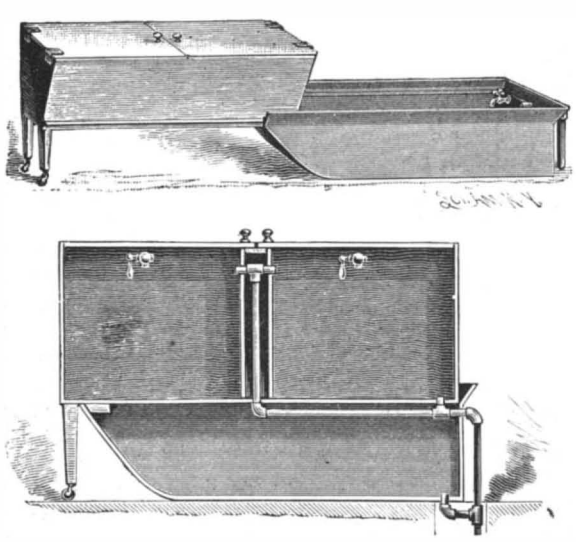
MARTINOT'S HEATER.

address Mrs. Mary White, No. 1541 Broadway, New York City.

A COMBINED BATH AND WASH TUB.

In the construction shown in the illustration either tub may be used independently as desired, and each has an independent overflow or waste, as shown in the lower sectional view. The improvement has been patented by Mrs. Mary L. W. Martinot, of New York City. The bath tub has a top flange extending around both sides and one end, with grooves adapted to serve as slideways for longitudinal ribs on the bottom edges of the wash tub, and the latter has, at one end, legs provided with castors, for its support when drawn out from above the bath tub, as shown in the upper figure. Stop blocks limit the outward movement of the wash tub, and branches of a waste pipe are carried up within the tub in the usual manner. The waste pipe of the wash tub has a sliding connection with the main waste pipe leading to the sewer or other outlet, with which the bath tub also has a bottom connection. When the bath tub is to be used, the upper tub is drawn out, as shown in the illustration, and is afterward returned to place above the bath tub previous to employing the wash tub.

For further information relative to this invention



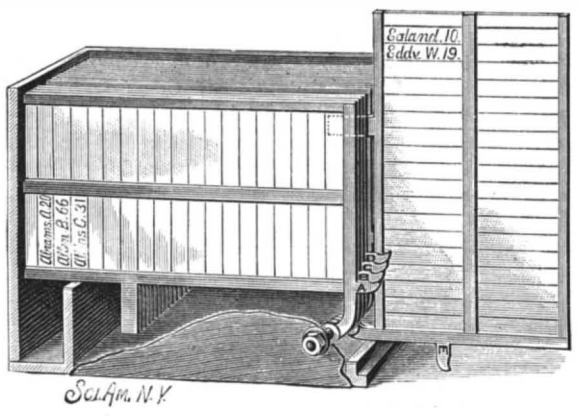
MARTINOT'S COMBINED BATH AND WASH TUB.

address Mrs. Mary White, No. 1541 Broadway, New York City.

THE body of every spider contains four little masses pierced with a multitude of holes, imperceptible to the naked eye, each hole permitting the passage of a single thread; all the threads, to the number of 1,000 to each mass, join together when they come out and make the single thread with which the spider spins its web, so that what we call a spider's thread consists of more than 4,000 threads united.

AN IMPROVED INDEX.

The illustration represents a convenient form of index, by means of which the references contained upon



JUDGE'S INDEX.

any page may be readily exposed to view, the reference cards or memoranda being inserted or changed with facility as desired. It has been patented by Mr. William A. Judge, of Santa Barbara, Cal. The index pages are held in a case open at the top and one end, there being near the inner end of the case a low transverse partition serving as a rest for the sheets in normal position in the case, and near the other open end a similar but lower support to hold up the displayed sheet. A rod held in suitable position by nuts extends through the case near the lower corner of the open end, and upon this rod is pivoted a series of bars each having a slight curve near its pivotal point, and each having a lateral ear adapted to receive an initial letter. These ears are arranged one above another upon the bars, so that all the letters will be exposed to view when the sheets lie horizontally in the case. Extending at right angles from the bars are strips provided with a suitable backing so attached as to form edge grooves, in which may be inserted in the desired order index slips of card or paper, thus making up each index page. Projecting from the lower or inner side of each sheet is a short strip, which extends inward between the adjacent sheets, as shown in dotted lines, when a page is turned out for reference, this strip serving as a guide to hold the sheet in place. Each index page is exposed to view by simply pressing downward upon the ear carrying the proper initial letter, the operation being reversed to return the page to place within the case.

A New Solvent for Cellulose.

BY C. F. CROSS AND E. J. BEVAN.

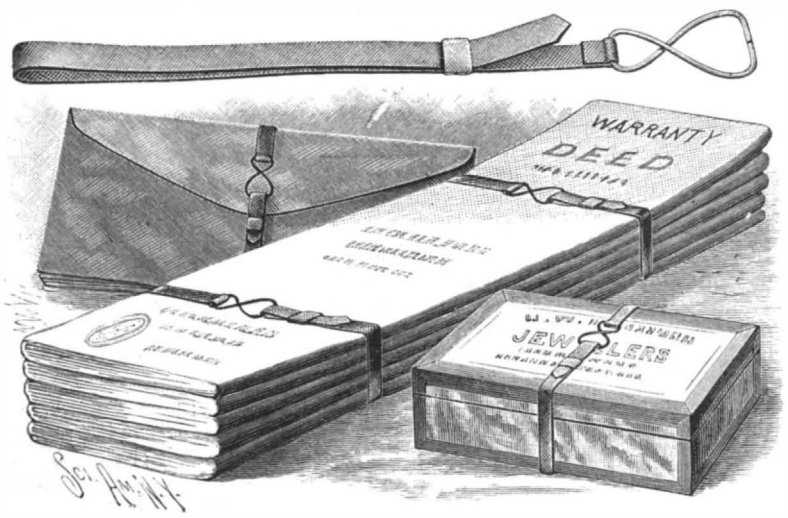
Hitherto we have had no acid solvent for cellulose but such as in dissolving it bring about marked changes in composition and properties. In dissolving, the cellulose is resolved, *e. g.*, by the action of sulphuric and phosphoric acids, into products of lower molecular weight, and cannot be recovered from the solution. Concentrated hydrochloric acid, as is well known, attacks cellulose profoundly. When digested with the acid in the cold the fibers are completely disintegrated, and the resulting modification, obtained as a white powder, manifests very different properties from the original. When warmed with aqueous solutions of the alkalies it is colored deep yellow, and the products of hydrolysis are powerful reducing agents (aldehyds). Some of the OH groups are also so affected that they react with acetic anhydride at its boiling temperature, giving, so far as our determinations show, the diacetate of a C_{18} compound. We find, however, that on dissolving in the acid one half its weight of zinc chloride, a solution is obtained (of specific gravity 1·44) which dissolves cellulose instantly and without sensible modification.

This observation is of importance, as it enables us to investigate some points in the constitution of cellulose for the determination of which such an acid solution is an essential condition. The solution of cellulose obtained by heating it with concentrated solutions of zinc chloride may also be diluted with hydrochloric acid, without precipitating the dissolved products, but the solution by the new reagent has the double advantage of being instantaneous and of being prepared, therefore, with the minimum of resolution of the cellulose into bodies of lower molecular weight which usually attends the somewhat prolonged heating necessary for complete solution in the aqueous solution of zinc chloride.

The reagent we also find of great value in the investigation of structural points, *i. e.*, as an aid to microscopic work in the province of the vegetable fibers. All forms of pure cellulose are rapidly dissolved by the reagent, and the various stages preceding their final disappearance may be observed under the microscope, the observation throwing much light on structural peculiarities. The raw fibers, *e. g.*, cotton and flax, are not dissolved, at least only partially, but swell up under the action of the reagent, with the result that the structural features are brought out with great prominence. Jute and the ligno-celluloses generally are dissolved by the reagent, and many of the adipo-celluloses also. We are investigating these actions more closely, and hope shortly to publish an account of our observations. In the meantime, we commend the reagent in question to all who are engaged in the chemical or microscopic investigation of the vegetable fibers.—*Chemical News.*

AN IMPROVED PACKAGE TIE.

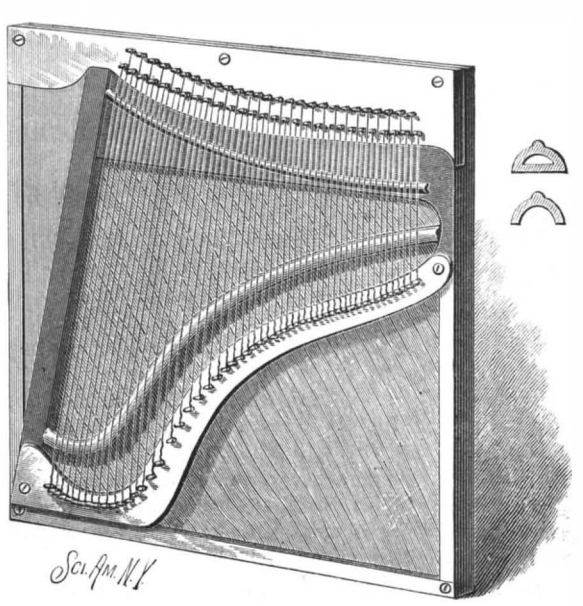
A tie for packages of documents and other articles, which can be readily and easily adjusted to suit the package, and which will not wear or fray out, as is sometimes the case with twine or tape, is represented in the accompanying illustration, and forms the subject of a patent issued to Mr. E. C. Plumer, of Columbia, S. C. The tie, shown separately at the top of the illustration, is made of a thin strip of pliable metal, preferably sheet copper, to one end of which is attached a bent wire link, the attachment being effected by bending the end of the band over one end of the link, where it may be secured by a small rivet if deemed necessary. The other end of the band is made slightly pointed, and is adapted to be passed through the other end of the link, upon which it is closely bent down when the tie is fixed upon a package, the end being secured, after adjustment, by a confining slide on the body of the band. This tie is comparatively indestructible and presents a very neat appearance.



PLUMER'S METALLIC BAND PACKAGE TIE.

IMPROVED SOUNDING BRIDGE FOR PIANOS, ETC.

A sounding bridge designed to greatly increase the volume of sound produced by a piano or other instrument in which the improvement is applied is shown in the accompanying illustration. It forms the subject of a patent issued to Mr. Martin Durick, of No. 567 Spring Street, Buffalo, N. Y. The improved bridge consists of a recessed strip of metal, curved in conformity with the wrest plank of a piano, and in cross section forming a hollow convexed bridge, as shown in one of the small figures at the side, there being a slight rib or projection in the top surface of the bridge upon which the wire rests. A modified form of this sounding bridge is made with a bottom wall, as shown in the other figure, the bridge then forming a hollow strip of metal. The main view shows the wrest plank with the sounding bridge in position.



DURICK'S BRIDGE FOR STRINGED INSTRUMENTS.

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Snow Worms.

Referring to a paragraph which appeared in the SCIENTIFIC AMERICAN of February 21, concerning the recent remarkable appearance of worms upon the surface of the snow, in Randolph County, Va., Mr. Geo. C. Hodges writes us that a similar phenomenon has been observed in the vicinity of Utica, N. Y., and in Oneida and Herkimer Counties. Specimens were sent by our correspondent to Prof. C. V. Riley, entomologist, Department of Agriculture, at Washington, who replied to him as follows:

"You send two distinct larvæ. The small species, of which there were 8 or 10 specimens, is the common Pennsylvania soldier-beetle (*Chauliognathus Pennsylvanica*), a carnivorous species which in the larva state destroys plant lice, bark lice, and the eggs and young larva of a number of injurious insects. This insect hibernates in the larva state and has occasionally been observed, both in Europe and in this country, fairly swarming upon the surface of snow, having been driven from its hibernating quarters by some peculiar weather combination. It hibernates at the roots of grasses, under stones and logs and under the loose bark of stumps, logs and old trees. The other and larger larva, of which there was only one specimen in the box, seems to be a variety of the bronzy cut worm (*Nephelodes violans*), an insect which also hibernates in the larva state, and has also been observed occurring in large numbers on snow. It is so recorded by your State entomologist, Dr. J. A. Linter, in his Fourth Report, published in the Forty-first Report of the State Museum, at Albany, N. Y., pages 54 to 57. He records the winter occurrence of this larva on snow at Rockville, Ontario, and Sullivan County, New York."

Amber.

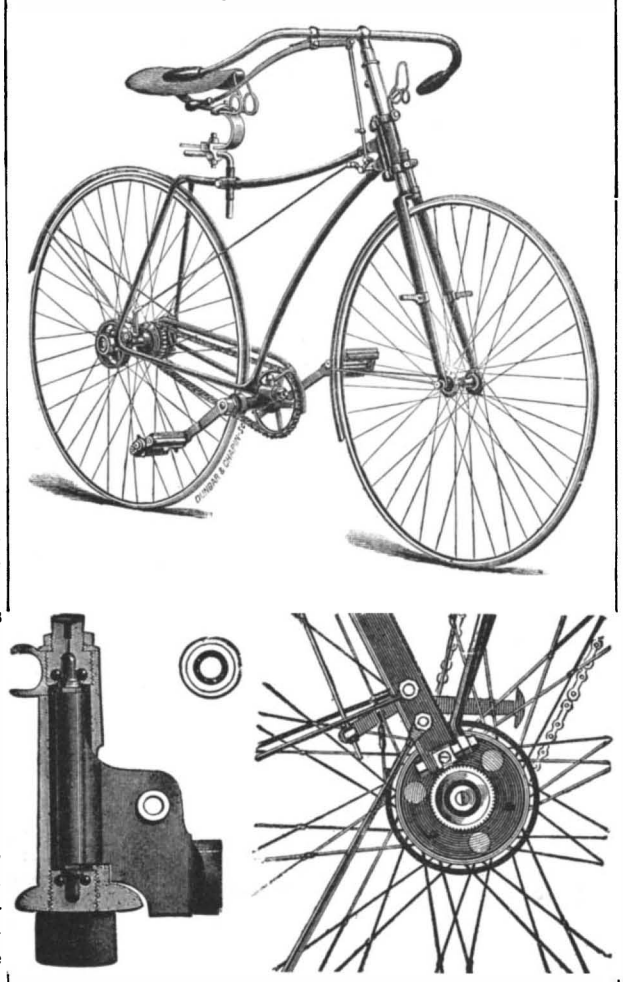
Genuine amber is by no means so plentiful as it was some years ago, and amber cigar holders and pipe stems will probably rise in price. The genuine amber is a fossil gum, which was produced in large quantities by trees having a resinous sap, which flowed down the trunks and collected in masses at the root. It is found in the ground of marshes and other places where forests flourished in former times, and is also obtained by dredging. The German Ocean, Baltic and Black Seas formerly produced it in great quantities, but the supply is constantly decreasing, and, unless other fields are discovered, real amber will soon be scarce and costly. There is some satisfaction in knowing that the imitation is just as good in every way, so that even if the real amber gives out there need be no diminution in the number of holders for cigars or mouthpieces for pipes. In this country comparatively little is used save for this purpose, but in India and China large lumps are in great demand, for, from some cause, an amber idol is far more highly esteemed than a golden image, and so the best amber all goes to the East to be made into gods for the pagans.—*Great Divide.*

A CENTENARIAN.

January 22, Colonel Nathan Whitney, of Franklin Grove, Ill., celebrated his one hundredth birthday. He was born in Conway, Mass., fifteen years after the declaration of independence, and was one of the pioneer settlers of Illinois, having lived within the State for fifty-four years. Before there was a sidewalk laid in Chicago and a bridge over the river, he was appointed a commissioner to organize Lee County and established his home on its prairies. He served in the war of 1812, and was mentioned for bravery at the battle of Lake Erie. Mr. Whitney had reached the age of threescore and ten when the first gun was fired on Fort Sumter. He has seen the development of the greatest nation on the earth from feeble States harassed by foreign foes, menaced by savages upon its borders, to a country of magnificent cities, which no internal war can disrupt and no foreign foe intimidate. He received his first degree of masonry seventy-four years ago, and is probably the oldest mason in the world. We present a portrait of Colonel Whitney, his son, grandson, and great-grandson, four generations. The one hundredth anniversary of Colonel Whitney's birth was made the occasion of a gathering of prominent masons from all over the State. Nathan Whitney Chapter No. 129, Royal Arch Masons, named in honor of Father Whitney, presented him with a solid silver platter, suitably inscribed, and several hundred congratulatory letters and telegrams were received.—*The Graphic.*

A STANDARD BICYCLE.

The New Mail, which is shown in the illustration herewith, has for years, throughout the country, been well known as a first-class wheel, its construction being of a high standard and it having special patented features which are much commended. It has a ball bearing head made after the Trigwell patent, according to which the balls are confined so they cannot fall out and be lost. By its use even and steady steering is obtained with little friction. Another specialty of the wheel is its band brake. It is a band of steel, lined with leather, acting on a drum on the rear wheel axle,



THE "NEW MAIL" BICYCLE.

entirely away from the chain. It is a very simple and positive acting clasp, and the New Mail is the only wheel having it. It is especially of added value this year when cushioned tires are to be used, as these are more delicate than solid tires, and English reports declare the band brake the best for such. The shape of the New Mail handle bars, also, is much approved, being curved and brought low and well back to the rider. The frame is of Credenda tubing; all ball bearings throughout; best hollow, re-enforced rims; tangent spokes, strongly tied and laced and nickeled to intersections. The New Mail is made at Chicopee, Mass., with all parts strictly interchangeable. A new pattern has also been brought out this year to meet the demand for a medium priced safety, having cushioned tires, which give life and elasticity and obviate all jar and vibration. Messrs. Wm. Read & Sons, 107 Washington Street, Boston, are the manufacturers of New Mails and will send full particulars on application.

The New Screw Ferryboat J. G. McCullough.

The new ferryboat for the Erie and Western Railroad, built at Neafie & Levy's, is of the same design as the Hoboken ferryboat Bergen, having a screw propeller at each end, the shaft running the entire length of the boat

The new boat is 215 ft. long over all, 188¼ ft. long between the stern posts, 45 ft. beam moulded, 62 ft. beam over guards, 16 ft. depth of hold amidships, having a gross tonnage of 744 tons. It is constructed throughout of steel.

The machinery consists of compound surface condensing engine, having cylinders 26 and 50 inches diameter by 30 inches stroke, driving a shaft with a propeller on each end 8 ft. 6 in. diameter. The engines are of splendid design, with the ordinary Stephenson link working a piston valve on the high pressure cylinder and a plain slide valve on the low pressure cylinder, and which are reversible by a separate steam engine. The circulating pump is of Neafie & Levy's make, centrifugal in design, and the independent air pump is of the Davidson type. All the bearings are of ample size, and all parts of the engine are perfectly accessible. The boilers are of steel, two in number, each being 12 ft. 8 in. in diameter by 11 ft. long, and supply steam at a pressure of 100 pounds. The engines being all below, but little space is taken off the driveways, enough only to pass the smokestack up, but it is in the side cabins that the enlarged space is appreciated, owing to the entire absence of the paddle wheel houses.

The cabins are wide, well lighted, and finely finished. The sides and ceilings are paneled and finished a pale green, with neat decorations in silver, which makes a most pleasing effect. The windows are very large, the central one in each cabin being of particularly handsome design. The seats are finished in cherry. The electroliers and metal fittings are of splendid design, finished in silver, matching the decorations. The outside is painted a light salmon color.

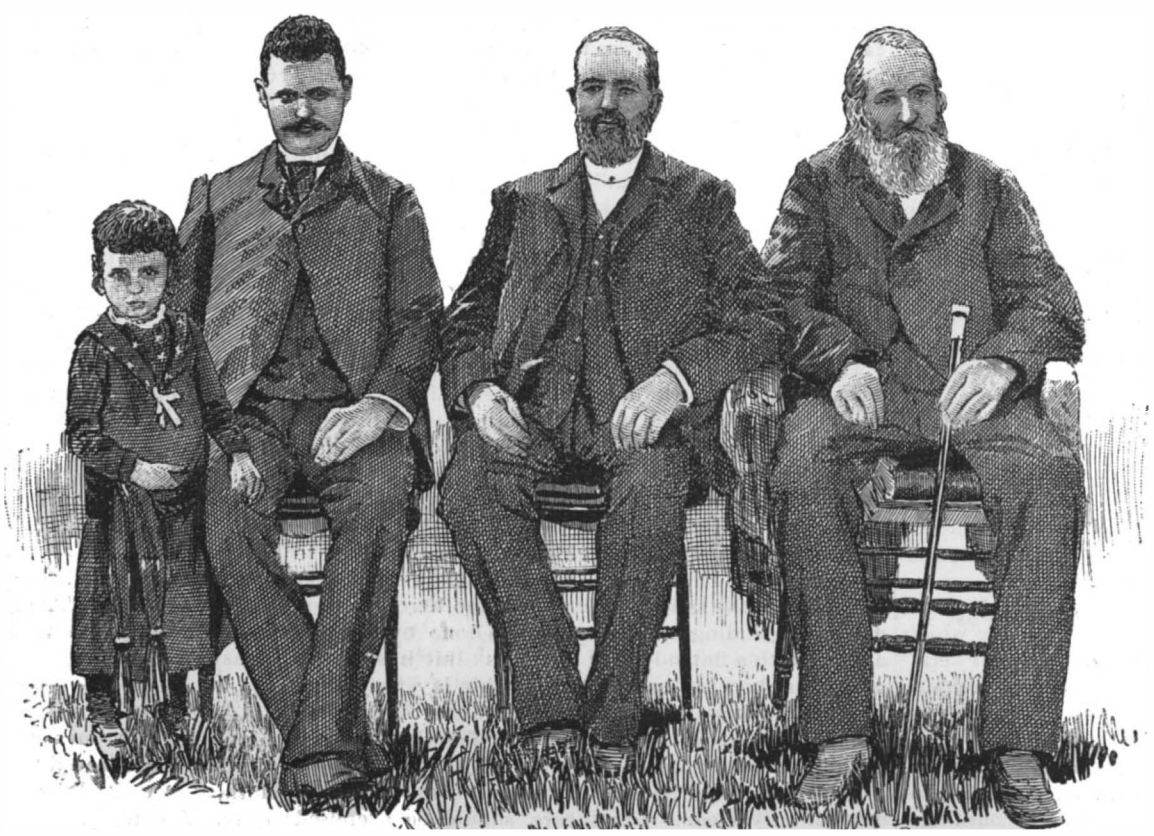
The boat is provided with the Williamson steam steering engines, capable also of being worked by hand. She is lighted all over by the incandescent light, and is in all respects the "most modern" ferryboat in the fullest sense of the word, and she will be the model ferryboat of New York harbor. She has been named John G. McCullough, and will be used for passenger service between New York and the terminal of the Erie Railroad, Jersey City.

Maine Shipbuilding in 1890.

During the year 1890, there were launched from the New England shipyards, according to the Bangor (Me.) *Industrial Journal*, 207 vessels, aggregating 99,842 tons, of which 125 vessels, with a tonnage of 74,465, were built in Maine. Massachusetts came next, with 54 vessels, of 13,603 tons, while Connecticut had 82 vessels, of 11,772 tons.

Of the Maine fleet, the most notable is the ship Shenandoah, which registers 3,406·78 tons gross, and 3,258·58 net, and is the largest wooden ship afloat. Also of great proportions, surpassed only by the Shenandoah, is the Rappahannock, registering 3,053 tons net. The Parthea, 2,371 tons, the St. Marys, 1,943 tons, the L. D. Carleton, 1,788 tons, were among the finest ships that ever left Maine stocks.

Schooners continue to largely predominate among the vessels built in Maine yards, and big fore-and-afters seem to be as popular as ever. The number of four-masted schooners launched is in the vicinity of 30, about one-half of whichslid into the waters from Bath ways. No less than 13 of these big fore-and-afters registered upward of 1,000 tons, yet they are not as large as the five-masted schooner Governor Ames, 1,690 tons, launched in Waldoboro in 1888.



COLONEL WHITNEY, HIS SON, GRANDSON AND GREAT-GRANDSON.

THE brownish discoloration of ceilings where gas is used is caused by dust, carried against them by the heated air currents produced by the gas.

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NEW FIRE BOAT FOR NEW YORK CITY—THE NEW YORKER.

The most important of recent additions to the apparatus of the New York Fire Department is what is termed the floating fire engine, the New Yorker. The new "fire engine" is a boat built of iron and steel, provided with powerful engines for propulsion, and with duplicate boilers and duplicate pumping plant for the extinguishment of fires. When the capacity of the pumps and general perfection of the design together with the applicability of the boat for delivering heavy streams of water many blocks in from the water front is considered, it will appear that it is a most valuable auxiliary for the protection of the city.

The boat and machinery are built of iron and steel throughout, under full specifications furnished by the department. The length over all is 125 ft. 5 in.; on load water line, 115 feet. The beam moulded is 26 ft.; on load water line, 25 ft. 2 in. The depth moulded is 14 ft. 6 in., and the extreme draught is 10 ft. The displacement is 351 tons. At the load water line the displacement is 52 tons to the inch.

The hull is laid upon a keel of bar iron 6 in. wide by 2¼ in. thick. The frames, spaced 20 in. from center to center, are steel angle iron 3 by 2½ by $\frac{6}{16}$ in. for three-fifths of the center of the hull, and 3 by 2½ by $\frac{5}{16}$ at the ends. Each side of a frame is in one piece, scarfs being prohibited.

The plating of the sides is laid "in and out," with thick strakes out. The garboard and sheer strakes (extreme upper and lower rows of plating) are 30 in. wide and ½ in. thick. The intermediate strakes are $\frac{7}{16}$ and $\frac{6}{16}$ thick respectively. The plates are all of steel.

For the woodwork, where such is introduced, white oak and locust are generally used, except for the deck and joiner work. The deck is of 3 in. white pine, and laid with the greatest care. Wherever cleats come, a white oak bed is laid for them, and white oak partners surround the bitts.

The bilges are coated with not less than one-half inch of Portland cement. This is brought up to the level of the limber holes, through which the bilge water finds its way to the pump well. Thus no water can lie stagnant between the frames.

For the iron an elongation of 20 per cent and tensile strength of 45,000 pounds, with 41,000 across the grain, and for the steel an elongation of 22 per cent with a tensile strength between 55,000 and 65,000 pounds per square inch, were prescribed.

The deck house is much lower than on other boats of this general class, rising only three feet above the deck. It is built of iron frames and plates. The pilot house rises 8 feet 9 inches from the top of the deck house (trunk deck) and is 15 feet long and 15 feet 9 inches wide, with 7 feet height of ceiling.

The boilers, two in number, are of the "Scotch" type, cylindrical, with corrugated furnaces. They are built for a working pressure of 148 pounds. Each is 12 feet diameter and 15 feet long, with 204 tubes of 3¼ inches outside diameter. The outside sheets are thirteen-sixteenths inch thick, and other portions of reduced thickness. Artificial draught is provided, and the boilers can be worked together or independently.

The propelling engine is of the triple expansion direct inverted type, 24 inches stroke, with 15, 24, and 39 inch cylinders. The high pressure cylinder has a piston valve, the others have slide valves. It can work up to 135 revolutions per minute with 135 to 150 pounds boiler pressure.

The propellers are two in number. The fixed or forward screw is 7 feet 9 inches diameter by 12 feet pitch. Back of this comes the "Kunstadter" swiveling screw and gear. This is connected by a universal joint to the shaft, which joint comes in line with the axis of rotation of the rudder. Thus the screw is swung to right or left with the rudder and aids in maneuvering the boat. It has been found highly efficient.

One independent air pump and a circulating pump for the condenser is provided. The condenser is of the tubular pattern, with about 2,000 square feet of condensing surface. Steam steering gear and engine are provided in addition to the regular hand steering apparatus.

For signaling, a steam chime whistle and a steam calliope are provided.

The pumping machinery is of great power. It comprises two duplex vertical direct-acting pumps. Each has two steam and two water cylinders. The steam cylinders are 16 inches diameter by 11 inches stroke. The water cylinders of the same stroke are of 10 inches diameter. The working pressure allowed for the water cylinders is 200 lb. to the square inch.

The pumps draw water in through two 16 inch suction openings in the bottom of the vessel, to which suction pipes are connected. The discharge is delivered through 9½ inch connections into a 12 inch main, that runs around the trunk or deck house, and which is provided with numerous connections for hose couplings. Several 12 inch valves are placed in the circuit, so as to shut off any desired portion. The line is provided with a number of 3½ and 6 inch hose couplings. Four 7 inch hand pipes are also carried upward, two to the roof of the pilot house and two aft through the trunk. These are surmounted by swivel nozzles adapted for throwing 5½ inch streams if desired. A fifth swivel nozzle is mounted on the bitts forward, and connects by hose with one of the large connections. Altogether thirty-two discharges are provided for.

The hand pipes are manipulated from behind traveling screens, made of double sheet steel with one inch air space, perforated for hose pipes, and with peep holes. These can be moved fore and aft to any desired point along the rail, and protect the firemen. There are three of these on each side. They are carried on rollers, which work upon the rail and upon the plank sheer with guides. Any screen can be lifted off its bearings and carried to the other side of the deck. Movable fire screens are provided for windows, which screens are kept stored away when not in use. Those for the pilot house windows have peep holes.

As an additional protection four spray pipes are carried up along the front of the pilot house and elsewhere, with cap and hose connection at the top. The object of these is to distribute water in a spray or rain-like form over the deck of the boat. In this way the hose is protected in situations where the heat is great.

Upon the trunk deck are two swiveling hose reels on which the hose is kept. Of this there are 3,000 feet, ranging in size from 2½ inches to 6 inches diameter. A great variety of nozzles or discharge pipes are provided, of about every size from 2½ inches up to 5½ inches diameter.

The capacity of discharge is put at 10,000 gallons per minute, with the pumps making 200 revolutions.

In connection with the boat a tender is kept on land. When the boat answers an alarm the tender meets it at the dock. This tender carries 1500 feet of 3¼ inch hose. Thus, a fire half a mile inland from the river front can be supplied with water in case the supply of city water is deficient.

As the boat lies at the dock, fifty pounds of steam is maintained in one boiler, and the fires in the other are kept ready for lighting. On an alarm from its district being received, the lines are cast off, the artificial draught is started, and the boat is at once under way.

No official trial of the boat has yet been made. On an unofficial trial the speed was found to be high, or about 15 knots. A 5-inch stream of water was thrown about 250 feet. The full record of her capacity, engine power, etc., has yet to be made up.

The hull was built by Jonson & Ellison, of this city; the engines by Brown & Miller, of Jersey City, N. J.; the boilers by McNeil & McLoughlin, of Brooklyn, N. Y. One set of pumps was built by the La France Fire Engine Company, of Elmira, N. Y.; the other by the Clapp & Jones Manufacturing Company, of Hudson, N. Y.

The total cost is put at $100,000. A district extending from Twenty-third Street, on the Hudson River, to Grand Street, on the East River, is assigned to its protection. There are sleeping accommodations in forecastle and aft cabin. It is proposed, ultimately, to have quarters on the dock for some of the men to sleep in.

Our thanks are due to Chief Hugh Bonner, of the New York Fire Department, for information concerning the boat.

Crystalline Glass.

NICHOLAUS T. NELSON.

Few trade secrets have been kept so well from the knowledge of the general public as the process of producing the above mentioned species of decorative glass. It is said to be the invention of a French engineer, who called it "vierre gievre," or frozen glass. In the United States, where its manufacture has been brought to a much greater state of perfection than in any other country, it is known under the more common names of chipped or crystalline glass, and the operation of manufacture "glass chipping." It has a remarkable appearance, being covered with fern-like figures, no two of which exactly resemble each other, differing in both shape and form. To those unacquainted with the method of producing this glass—and there are very few that have any conception of how it is made—the process of manufacturing is very puzzling.

This method of ornamenting glass is so simple that most people, when they have it first explained to them, will hardly believe that such simple means can produce such marvelous results. It is done by covering glass with glue, which adheres to the glass, and when the glue dries it shrinks and draws with it pieces of the glass or chips of glass.

The first necessity in carrying out this process is to have the glass which is to be ornamented ground either by means of the sand blast or by the more troublesome means of grinding by hand. This is done by rubbing a stone with a flat side over the glass till it has lost its polish and become translucent. A thin layer of emery kept wet with water will facilitate the grinding, which should be as coarse as possible, and for which reason grinding done by the sand blast is preferable.

After the glass has been ground it should be kept scrupulously clean. Great care should be exercised that the surface is not touched by the hands. Any trace of grease is very apt to make the results uncertain. If the glass has, however, become contaminated, it may be cleaned with very strong ammonia, although glass which it has been necessary to clean is apt to be rather unreliable.

When everything is ready the glass is placed in a room where it is intended to carry on the process, accurately leveled, and flowed with a solution made as follows:

Good glue is placed in sufficient water to cover it and allowed to soak for twenty-four hours. If the water is absorbed during the soaking, more may be added. It is then liquefied over a water bath and is then ready to use.

In practice it makes considerable difference which kind of glue is used. By repeated experiments it has been found that Irish glue is the best for the purpose.

A wide brush is dipped in the glue and applied to the glass. The coating should be a thick one, otherwise it will not be strong enough to do the work required. When the plates are coated they may be placed in racks, and the temperature of the room raised to 95 or 100 degrees F. They are permitted to remain at this temperature till they are perfectly dry, which will be in from ten to twenty hours.

It is at this stage that the uncertain character of glue shows itself. Under certain circumstances the glue will begin to crack and rise of itself without any more manipulations, but most generally it will require to have a stream of cold air suddenly strike it. If the plate is perfectly dry at this period, and of sufficient thickness, the top surface of the glass will be torn off with a noise resembling the crack of a toy pistol. Sometimes the pieces of glue will leap two or three inches into the air, and may even fly into the eyes and injure them. To guard against this it is customary for the workmen to wear a pair of spectacles fitted with plain glass. The glue will come off sometimes at the least expected times, notably if the plate with dried glue is being carried from one room to another. Plates which have shown a decided disinclination to chip have manifested a remarkable and unexpected activity and have jumped into the face of the person carrying them in such a manner as to cause him to drop them.

The strength of the glue is something very extraordinary. If the glass has been coated on the hollow or belly side of the glass, the slight leverage thus obtained is almost sure to break it, especially if the glass be single strength. Even plate glass is not unfrequently broken. It might be a rather interesting mathematical calculation to find out the force necessary to separate the surface of glass in this manner on a piece say 48 by 48 inches.

The result of the operation described may be various. It may be either a design resembling ferns of various shapes and sizes, or it may be a circular design, exhibiting narrow, feathery appearances; or, if unsuitable glue has been used, it may be of a nondescript appearance.

If, after the glue has been applied, but before it has become any more than set, a piece of stout paper is pressed over it and it is allowed to dry in this way, the glass will have less the appearance of feathers, but will be much coarser and larger pieces will be removed.

The circular design mentioned occurs under the same circumstances as the other, with the exception that it generally is made during cold weather. Sometimes several weeks may run along and nothing but this formation be made.

Some very elegant designs may be produced by submitting the glass once more to the same operation, covering it as before and allowing the glue to chip. This is known by the name of double chip. If the glass was covered with the small circles in the first place, the second time it will have an appearance very much resembling shells, and for this reason this has been called shell chip.

If, instead of using ordinary glass, colored glass is employed, pretty and original effects may be obtained. The glass may be either colored clear through or it may have only a thin coating on one side. In the latter case in some places the entire layer of colored glass will be removed, and in other places only a very little, and will therefore give all the gradations between those two extremes.

Glass which has been treated in this way may be silvered and gilded and thereby be made still more remarkable in appearance.

Extremely elegant effects may be obtained by what is known as "chipping to a line." The design is ground in the glass by the ordinary sand blast process. After the glass has passed through the machine, the protective coating (wax is generally used) is not removed, but is left on to keep the glue off those parts which are not intended to chip. The glue is then applied in a thick layer to the ground portion and the process is carried on as usual.

A Simple and Excellent Furniture Polish.

One part by measure of olive oil and two parts of vinegar. Shake well together and apply with a woolen cloth, after which take a dry woolen cloth and rub vigorously. A housewife who uses this says it is a first rate, reliable furniture polish, always to be depended upon for giving most satisfactory results.

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Correspondence.

To the Editor of the Scientific American:

Inclosed find clipping from the *Times* in regard to the storm here. Please explain in SCIENTIFIC AMERICAN. H. C. MORRILL.

White Lake, South Dakota, Feb. 12, 1891.

"On Saturday night last, at about eleven o'clock, the wind raised and snow commenced to fall, the two making what is commonly called a blizzard, and continued until about four o'clock Monday morning. It was not so cold, but otherwise was as severe a storm as that of January 12, 1888. We have heard of no casualties or suffering, as people were generally at home and stock housed. One peculiarity of the storm was the large amount of electricity notable everywhere, persons coming in contact with each other or with any metal substance, or two pieces of metal, or in fact any two objects that were not non-conductors, would throw off visible flashes with a sharp snapping sound. When this happened to persons a very perceptible shock was felt, even through thick clothing. It was a very peculiar although accountable occurrence."

[The phenomenon described in the slip is a winter electric storm. These storms are not frequent, but well understood by meteorologists. They are also called magnetic storms, because the magnetic needle is strongly affected during such electric manifestations. Their origin is supposed to be coincident with the development of auroras, and probably caused by disturbances in the sun that produce sun spots. Their coincidence has often been the subject of astronomical observation and record.—ED.]

Honor to Whom Honor, etc.

THE INVENTOR OF ARBOR DAY.

To the Editor of the Scientific American:

In the number of your paper for January 10, 1891, in an article on "American Forestry Congress," credit is given to B. G. Northrup, Esq., for the invention of Arbor Day, saying that Mr. Northrup "suggested" the idea of making such a holiday "eight years ago at St. Paul." Your article closes by the remark that the benefits derived and derivable from Arbor Day "entitle Mr. Northrup to be regarded as a national benefactor."

Truth compels me to ask a correction of your historical facts.

"Arbor Day" was invented by Hon. J. Sterling Morton, of Nebraska City, Nebraska. "At an annual meeting of the Nebraska State Board of Agriculture, held in the city of Lincoln, January 4, 1872, the Hon. J. Sterling Morton, of Nebraska City, introduced the following resolution, which was unanimously adopted:

"*Resolved*, That Wednesday, the 10th day of April, 1872, be and the same is hereby especially set apart and consecrated for tree planting in the State of Nebraska, and the State Board of Agriculture hereby names it Arbor Day," etc.; the balance of the resolution relating to prizes to the county and person planting properly the largest number of trees on that day.

More than one million trees were planted on the day named; and similar and increased results obtained in 1873. March 31, 1874, Governor Robert W. Farnas proclaimed April 8 as "Arbor Day," and requested the whole people of the State to observe it as a voluntary holiday.

Similar action was taken by succeeding governors until the session of the legislature of 1884–85 passed an act making April 22 of every year a legal holiday.

The State Board of Agriculture gives annual premiums about as follows:

Greatest number	$50
Next greatest	25
Greatest number hard wood	25
Greatest number of cuttings	10

A conservative estimate by the State Board gives the total number of trees planted under the operations of Arbor Day, between 1872 and 1888, as nearly *two thousand seven hundred and fifty millions*, a number which at only two feet apart each way would cover an area of nearly *eleven hundred square miles of land.*

Arbor Day has been adopted by other States. It should be by all. Besides its specific object—the encouragement of forestry in all its aspects—it is, quoting from a letter written by the author (inventor, as I call him), Hon. J. Sterling Morton, to the subscriber: "The only anniversary facing the future. All others turn to the past. Arbor Day blesses posterity, and leaves adulation of the ancients to birthday festivals."

I would not detract from any praise due to Mr. Northrup for his suggestion to extend the observance of Arbor Day; but the real honor of a suggestion which is to benefit not only the nation, but all mankind, in all justice belongs to the distinguished gentleman whose name has been given. AUG. F. HARVEY.

St. Louis, Mo.

DR. OTTO.—The death is announced of Dr. N. A. Otto, the inventor of the Otto gas engine. Dr. Otto died at Cologne, in his fifty-ninth year.

Notes on Quarrying.

WM. L. SAUNDERS.

The drill steel is, perhaps, the quarryman's closest companion during his hours of labor. Even where quarries are equipped with all modern conveniences, and whether or not the power drill is used, the drill steel always has its place. Hand drilling in rock is not as simple an operation as it appears to the uninitiated. It looks an easy thing for a man to stand up and shake a "jumper" between his toes, or to sit on a one-legged stool and drive a piece of steel with a hammer, but skill and experience are required to do effective work in either case.

I did not realize that there was much antagonism between the jumper and the hand drill, as it seemed to me that each one had its place, but I have recently talked with an intelligent quarryman whose experience has been confined largely to Europe and Australia, and he insists with much positiveness that the jumper can outdrill any hammer and steel system under any and all circumstances. It is doubtless true that the jumper is the most popular drill in the quarries of foreign countries. It is the standard hand rock drill, and its use among quarrymen extends to hard and soft stone alike and to deep and shallow holes; but with us the jumper has its place, and is only used where we find by experience that it is better to so use it as against any other device for the purpose. In several rocks, notably the oolites of Indiana and Kentucky, the jumper is the best hand rock drill. We use it in soft rock for all "down" holes, whether shallow or deep. Its simplicity is very much in its favor, and a man who has become skilled in its use can do more work at less expense in time and material than with a hand drill.

Where the rock is as hard as granite it is difficult to start holes well with the jumper. Quarrymen abroad become so skilled with it that they are able to guide it with considerable accuracy in starting holes; but at best a jumper cannot compete with the hammer drill in putting in shallow plug and feather holes in hard rock. Where deep holes are put in, it is best to start with a hammer until the hole is several feet deep and then use the jumper, as the effect of the hammer blow in drilling rock is very much lessened by the distance between the point where the steel is struck and the bit. In the case of the jumper the reverse is true, that is, the deeper the hole, the more effective is the blow because the steel is heavier. The "drop drill," such as is used for artesian well boring, is an illustration on a large scale of the principle of the jumper. A drop drill strikes with considerable force. In deep well boring, where a heavy piece of steel is used, the blow is greater than that of the largest steam drill. This is because the drop drill is heavier and moves through more space, that is, it has a longer stroke. The advantage which the steam drill has is that it strikes faster.

The steel consumed in drilling is seldom taken into account when figuring on the expense of quarrying. When using hand drills with hammers the consumption in steel is twice as great as when using the jumper or as when drilling by power. This is because the hammered steel wears at both ends. As a general thing the loss of steel is equally as great on the head as on the bit. In the case of power drills the loss is entirely at the bit. Several years ago I removed about five thousand cubic yards of rock by submarine blasting and lost three hundred and ninety-five pounds of steel by abrasion and dressing. This amount is not excessive when compared with sandstone quarrying, where the bits are rapidly worn by the grit. It is greater than would be the case in ordinary limestone quarrying, because submarine work involves many difficulties, and the proportion of holes drilled to rock removed is greater than in surface quarrying.

Let no one be deluded by those who claim to furnish machine hand rock drills. There is no such thing at the present time as a successful hand drill other than a jumper or a piece of steel struck by a hammer. The Patent Office records testify to the misguided enthusiasm of inventors in no more conspicuous manner than in the exhibit of hand rock drill patents. There have been, perhaps, as many patents taken out on hand rock drills as on power drills. In every case the inventor aims at something beyond the limits of reason. He seeks to do more work with a machine in the hands of a human being than that person is capable of performing. He seems to labor under the impression that a machine creates power, when, as a matter of fact, it only utilizes, distributes, or transmits power. Every person is gifted by nature with a certain capacity for work. He cannot exceed that capacity. He is limited by power, which is represented by strength, and by time, which is represented by endurance. In other words, he is like a lever which may lift a heavy weight slowly or a light weight rapidly, but in each case the weight and the time when multiplied together give a result which is the same.

A man when drilling by hand is the source of power, just as the boiler is the source of power for a steam drill. In order to get the full measure of power out of a man when drilling rock, his method of work should be simplified as much as possible. His movements should be easy and natural. There should be as little machinery and as little friction as possible. Give him a piece of steel and a hammer, and he has not only the simplest equipment for the work, but in wielding the hammer he follows natural laws, and is able to stand greater endurance.

A man may chop wood with an ax for hours without stopping, but in turning the crank of a grindstone he must pause for rest. Some men have invented hand rock drills with this view, and have complicated them by levers in an effort to get the natural motion of a man, but they forget that any machine when run by a man reduces that man's capacity for work.

A sewing machine has been instanced by those who doubt the truth of these arguments. A sewing machine enables a person to do more work than he otherwise could do, because the kind of work is such that it does not call for his full energy, and the way it is done is such that he cannot do it fast enough. The machine enables him to utilize more of his energy. But the case of drilling rock is different. It requires force. In order to make progress in hard rock we must give a hard blow. The progress in depth of hole drilled is in direct proportion to the strength of blows multiplied by the number of blows dealt per minute. If a man swings a heavy sledge he hits a harder blow, but there will be less of them. With a light sledge he strikes more rapidly, but in each case, provided the light blow is heavy enough to do work, and provided the man uses his full capacity for work, the net result will be the same.—*Stone.*

PHOTOGRAPHIC NOTES.

Obtaining Warm Brown Tones on Bromide Paper or Lantern Slides.—Two formulæ given by Mr. Robert Talbot in the *Photographische Neuheiten*, the author states, have proved to be very successful in his hands:

1. With uranium nitrate. This method is very well suited for Eastman positive paper, as well as for transferrotype paper. After the prints have been fixed, washed, and eventually transferred, the following two solutions are prepared:

Solution A.

Ferricyanide of potassium	5 grammes.
Water	500 c. c.

Solution B.

Uranium nitrate	5 grammes.
Water	500 c. c.

Just before use, equal parts of solutions A and B are mixed. The print is immersed in the solution until the desired tone has been obtained, then washed thoroughly, and placed once more in the fixing bath:

Water	100 c. c.
Hyposulphite of soda	20 grammes.

After five minutes it is removed and well washed. The above gives warm red tones. Warm brown tones are obtained if the print is allowed to remain in the above bath until it begins to acquire a brown color; it is then immersed in a weak alum solution, when it is rinsed, fixed as above, and again thoroughly washed.

2. With potassium chloride. Three solutions are prepared:

Solution A.

Water	1,000 c. c.
Potassium oxalate	330 grammes.

Solution B.

Water	1,000 c. c.
Potassium chloride	130 grammes.

Solution C.

Water	500 c. c.
Sulphate of iron	24 grammes.
Citric acid	2 "
Potassium bromide	2 "

The paper should be fully exposed, and then soaked in clean water. Then mix:

Solution A	20 c. c.
" B	5 "
" C	5 "

The more of B is taken, the browner will be the tone. The print is cleared, fixed, and washed as usual.—*H. E. Gunther, in Photo. News.*

Life Insurance.

The prime thing desired by any one paying money for life insurance is a sense of absolute surety that the amount called for by the policy will be promptly paid when it becomes due. With vast resources, and with a successful record of now nearly half a century in the business, the New York Life Insurance Company is in a position to satisfy the applicant for life insurance that the conditions of any contract with the company will be faithfully carried out. The forty-sixth annual report of the company, a summary of which appears on another page, presents a striking picture of its great strength and steady prosperity. It affords also the best of evidence of the careful management of resources as large as are involved in the conduct of many of the governments of the world. Over one hundred thousand people availed themselves of the care of the company during the year 1890. Over thirteen million dollars were paid to policy holders during the year, and it is said that the company carries about fifteen per cent of all the insurance in force in American companies.

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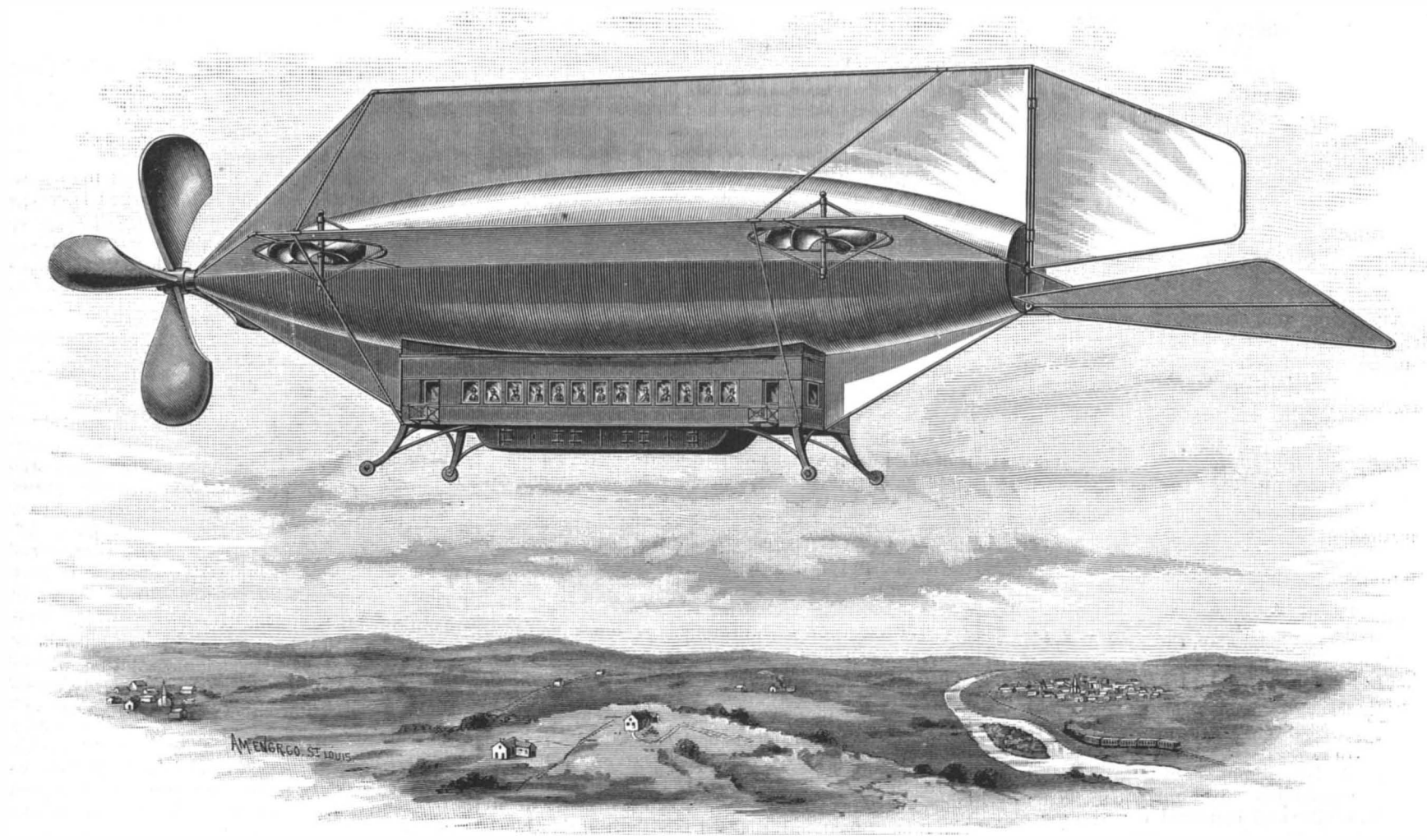
THE PENNINGTON AIR SHIP.

The rapid strides which of late have been made in the practical applications of electricity have prepared the way, in the public mind, for the ready acceptance of almost any new and striking proposal. In the popular belief the flying machine is next to an accomplished fact, and no very great surprise probably would be occasioned if the announcement were to be made to-morrow morning that a line of air ships had commenced to run between Chicago and New York. We are sorry, however, to be obliged to dash the hopes of a confiding public by the cold, unfeeling statement that the art of flying in the air by mankind has not yet been learned nor the means thereto invented. Looking at the subject from a practical point of view, our glorious people are likely, for some time to come, to be confined in their locomotion to the actual earth's surface, and to railway cars that make only from fifty to seventy-five miles an hour. But there are various schemes for air flying, and they look fine on paper. One of these paper enterprises has been widely made known in Chicago. It is styled the Pennington air ship. Twenty millions of dollars is the modest amount of the capital. A few of the shares have been reserved for sale to a hungry public. Those who have a dangerous surplus of cash on hand can promptly reduce it by investment in this deceptive and visionary scheme.



THE PENNINGTON AIR SHIP.

We give a picture of the machine as it is intended to appear by its enterprising projector, Mr. E. J. Pennington, of Mt. Carmel, Ill. Any one at all acquainted with aeronautics can see at a glance that an uncouth, bulky device like this must be lacking in the essential elements of a successful flying machine. The inventor says:

"The main part of the machine is the buoyancy chamber. This in shape is an oblated spheroid, being large at the center and tapering symmetrically to a point at either end, and looks like a huge cigar. On the inside of this chamber are two compartments; one is a receptacle for gas and the other is used as an engine room. The engine that occupies this room is a three-cylinder rotary and propels the large wheel in front of the ship. The fuel that supplies this engine is gas and is fed direct. The main shaft on this engine is hollow, and the large propeller is keyed directly on to it. This shaft is made hollow to allow the air to pass through it in the cylinders to keep them cool. On the top of the buoyancy chamber is placed the sail. This extends its full length and can be manipulated so that the currents will act to propel the ship as it does a sailing vessel in water. Attached to this sail is the rudder that guides the ship either to the right or left, and underneath this rudder is the tail; this tail is patterned after a bird's tail, and is used to raise or lower the ship independent of the propeller wheels at the sides. On the sides of the chamber are placed the wings. These wings are so made that when the ship is descending they improvise themselves into parachutes, which makes the descent gradual. On each of these wings are placed two propeller wheels, for raising and lowering the ship.

"Underneath the chamber is hung the cabin, and underneath the cabin are placed the storage batteries. The weight of these batteries make them useful for ballast, and are used to keep the ship in the proper position. On the four corners of the cabin are the stands, or brackets; these are cushioned, and when the ship alights not the slightest jar is perceptible. To explain how the ship is started, we will suppose a trip is about to be made; enough gas is put into the buoyancy chamber to make the whole ship weigh nothing, the propellers are gradually started and the ship gently rises from the surface of the earth until a height is reached to clear the tree tops and buildings in the course to be traveled. If there were any mountains or hills to clear, a uniform height could be attained at the start, so that a straight course to the destination could be made. When it is desired to make a landing the ship's bow is headed to the wind, and the rudder set so that the current of air will place the ship at the desired point, the same way that a landing is made by a steamboat. The whole construction being of aluminum makes it lighter and stronger than any other material; that is, it will take less gas to raise it, and the great tensile strength of this metal will allow it to be rolled thinner than silk and still retain as much strength as steel three times as thick. The gas engine and all other mechanical devices on this ship are patented, which gives the company the exclusive benefit of their use for a long time."

The use of the storage batteries is not explained; probably, however, they are for lighting the cabin. Where the gas is to come from to work the gas engines is not set forth.

To assist in floating this stock-jobbing enterprise the promoters have made what they call a practical demonstration of the invention on a small scale, which is now exhibited in the exposition building, Chicago. This little side show consists of a thirty-foot cigar-shaped balloon, inflated and raised by gas, and worked by means of a fan propeller, operated by a small electric machine carried below the balloon, which electric machine is worked by means of a wire extending from a battery on the ground. This float is tied to a string, and when the current is turned on, the machine moves slowly around in a 50 ft. circle in the still air of the building. It is said to be interesting to see this cigar balloon move; but as a demonstration of anything new or promising in the way of aerial navigation it is without value.

New Batteries to Protect New York City.

The government has recently commenced the work of locating batteries at Sandy Hook, to take the place of the old fort at that point, begun in 1858. Between that date and 1867 it is said over $1,000,000 were expended on this fort, which was to have been one of the most formidable in the world, but has become obsolete by the vast development which has taken place in modern heavy ordnance. The new batteries are designed to have twelve-inch guns and sixteen-inch mortars, with a range of from nine to twelve miles.

The Economy of the French.

While the description by Eli Perkins of the French stove and its varied uses may be somewhat exaggerated, it none too forcibly illustrates the habits of the French people in their household economy.

"The stove is about the size of an ice-water tank in a Pullman car. It is loaded with two quarts of coal, the small three-inch pipe adjusted to the chimney and the coal lighted. After burning awhile the draught is shut off, and the stove is wheeled around the room. The room is warmed in sections. First it is wheeled up to the old man, who throws out his fingers, then across to the old lady, who embraces it, and then up to the baby. Then it is wheeled back to the chimney, the draught opened, and the fire rekindled. There are usually two chimney holes about the room. After one room has been treated to a fire, the stove is rolled into the hall or into another room, or taken by the handle and carried up stairs. The same stove is used in the bed room to dress by, rolled into the breakfast room like a baby carriage, then into the sitting room. It is *multum in parvo*. It is a cook stove, fireplace, and furnace. The American who burns ten tons of coal in a range, twelve tons in a furnace, and two tons in grates is amazed when he sees a whole house in Paris warmed with one ton of coal. The twenty tons used by the American would warm the Boulevard des Italiens. Such overstrained economy has, however, its disadvantage in loss of health, and occasionally of life itself."

The Illuminating Power of the Edges and Sides of Flat Oil Lamp Flames.

Mr. Alfred M. Mayer has contributed to the *American Journal of Science* a paper on the illuminating power of flat petroleum lamp flames in various azimuths. The experiments were conducted with two varieties of flat flames—one being the flame of a Hitchcock lamp, in which combustion is maintained by a blast of air driven against the flame by a fan moved by clockwork, and the other a flame of an ordinary flat wick lamp. The latter flame was surrounded by a chimney; the former was not so inclosed. The following results were determined photometrically for each flame at three of the azimuths for which observations were taken. The angles were measured from the plane of the flat flames, and the results are expressed in standard candle power.

Azimuth.	Hitchcock Flame.	Ordinary Flat Flame.
0°	9·8	6·6
50°	15·8	10·25
90°	15·6	10·6

It therefore appears from these experiments that the edges of the Hitchcock flame and of the ordinary flat lamp flames give respectively about 37 and 38 per cent less light than the flat surface. This observation favors the use of ground or clouded glass globes for all kinds of flat flames, whether of oil or gas, not only for the sake of appearance, but also for equalizing the light radiated in all directions.

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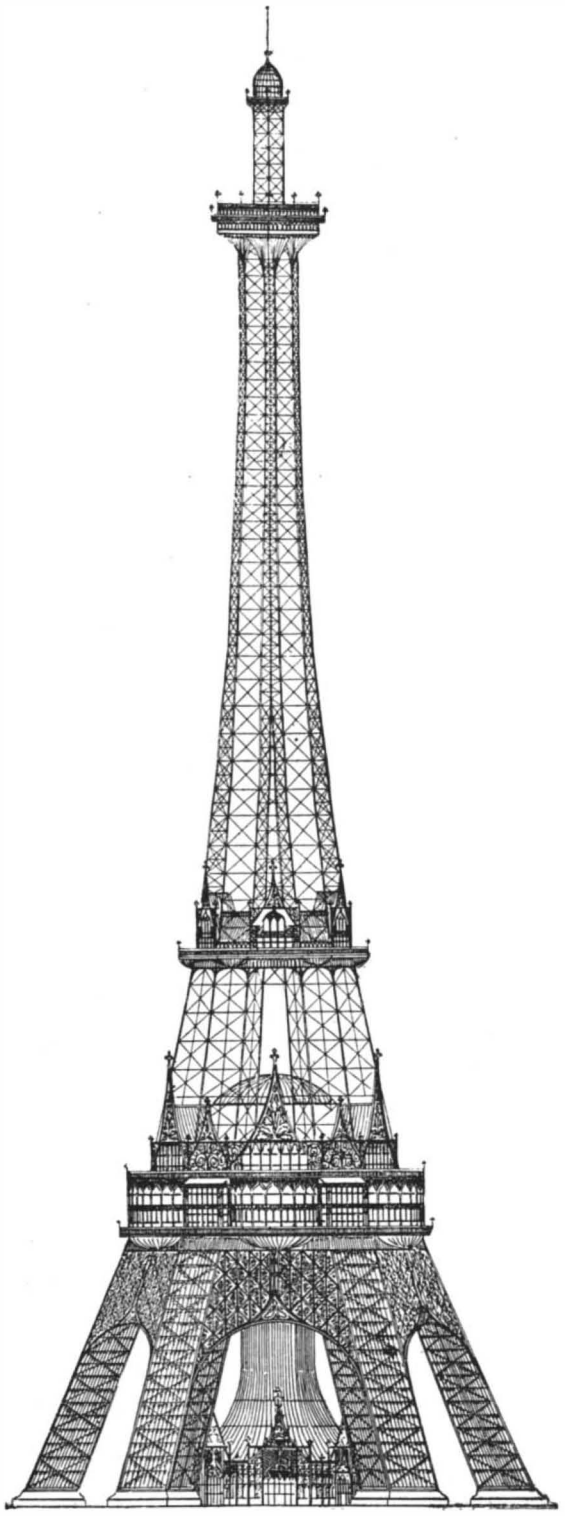
THE PROCTOR TOWER.

The building and grounds committee of the Columbian Exposition have accepted the design for a tower which we illustrate herewith. The tower is to be of steel, 1,100 feet high, surmounted by a tall flagstaff. Ten elevators will carry passengers to the top. Four of these will run to the first landing, 200 feet above the ground; two will run to the second landing, 400 feet above the ground, stopping at the first landing; while two others will run up without stop to the second landing; and from the second and third landings two will shoot up into the dome, 1,000 feet above the ground. The capacity of these elevators is 8,000 people per hour one way, or 16,000 people an hour up and down. The tower will be one glow of electric light from base to dome, the very top being illuminated by powerful search lights, which will throw a brilliant glow over the exposition.

Electricity will be used in numerous ways. Safety devices, telephones, signaling apparatus, ventilating



THE PROCTOR TOWER.

fans, being a few of the necessary things that will be operated by this subtile force.

Hydraulic power, in all probability, will be used for running the elevators in the tower. Motors, however, will be used to operate pressure pumps that supply the water to the hydraulic cylinders.

Messrs. Holabird & Roche, well known architects of Chicago, and Mr. C. T. Purdy, mechanical engineer, have the work of the tower in hand—a fact which is a sufficient guarantee of its perfect construction.—*Electrical Industries.*

Preserve for Binding.

The publishers of the SCIENTIFIC AMERICAN would advise all subscribers to preserve their numbers for binding. One year's issue (52 numbers) contains over 800 pages of illustrations and reading matter. The practical receipts and information contained in the Notes and Queries columns alone make the numbers worth preserving. Persons who have subscribed since the commencement of this year can have the back numbers sent them on signifying such wish. Their subscription will then expire with the year.

The Bone Grafting Experiment.

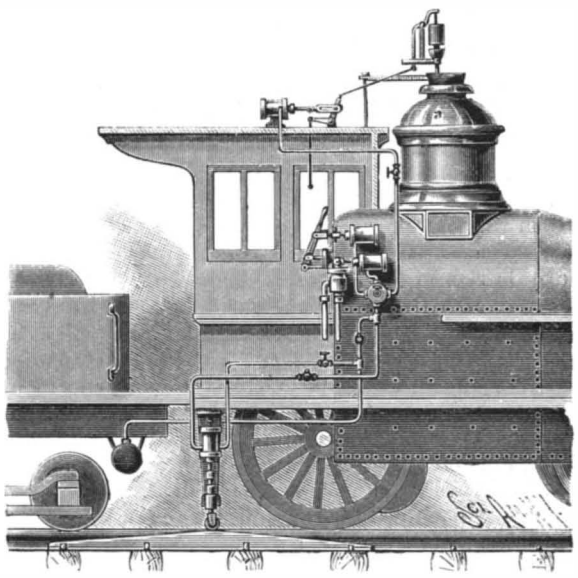
In the New York Charity Hospital, in November last, as described in the SCIENTIFIC AMERICAN of November 29, Dr. A. M. Phelps grafted a bone from a dog's leg in the shin bone of a boy, under circumstances which attracted general attention. Both boy and dog were bound side by side on a cot, where they might be kept as comfortably as possible for several days, anæsthetics were administered but moderately, and a piece of the bone about an inch and a half long was taken from the dog's limb and inserted in that of the boy, where it was ingeniously secured in position, care being taken not to injure the arteries or any important portion of the circulatory system of either. It was designed that the vitality of the dog should contribute to the growth of the bone in place in the boy's leg, which, it was estimated, would require about thirty days, and an artery of the dog was, therefore, conducted to the grafted bone, and muscle was stitched to muscle and skin to skin, to promote, if possible, a mutual growth. After three days the boy and dog became apparently comfortable together, and at the end of six days the wound was naturally healed, but at the end of eleven days there was an apparent shrinkage of the dog in the dressings, allowing of motion, and endangering the pulling of the graft from position, and the bond of union between the boy and the dog was then, on this account, severed. The operation had not been successful, but the bone graft was covered with an irregular new growth, and circulation was shown to have been established between the boy and dog. At the end of five weeks the graft was removed from the boy's leg, but the stimulation it had caused is said to have set up a reparative process, which gives hope that the original fracture may reunite. The boy now walks with the aid of one crutch or a cane, and the dog was carefully treated after the separation. Dr. Phelps is confident that bony union would have taken place with the graft if actual contact could have been maintained for a longer period, and says that "the operation is a success in so far as it establishes the principle that it is possible to grow large masses of tissue from an animal to man, and to establish the circulation until the union takes place between opposite species without danger to either. It also demonstrates that a growth of new bone takes place when a section of bone is transplanted and its nutrition maintained by the artery of the animal. This, if continued for four or five weeks, would probably unite a fracture."

Solutions of Celluloid.

Dr. Charles Ehrmann says: "Alcoholic solution of celluloid has been said to be an exceedingly fine retouching varnish. But celluloid is in reality not more soluble in alcohol than ordinary gun cotton or xyloidine. When small and tiny shreds of celluloid are macerated in alcohol of 95 per cent, the substance swells up like gelatine in water; the alcohol permeates its pores and dissolves the camphor contained, so that the final result is a solution of camphor, nothing else. We do not deny that a thin stratum of camphor upon the gelatine film will assist materially retouching with a graphite pencil, but the medium is by no means celluloid, which has proved to be so excellent to retouch upon. After macerating the celluloid in alcohol, and a thorough dissolution of camphor, washing it in water and drying, it will burn with detonation, exactly like gun cotton—proof enough that the alcohol had no other effect upon it than that above stated."

A STOPPING AND SIGNALING MECHANISM FOR LOCOMOTIVES.

A mechanism designed to automatically stop the locomotive and sound the whistle at or near stations, while not interfering with the operation of the engine by the engineer in the usual way, is shown in the accompanying illustration, and has been patented by Mr. James C. Gross, of No. 617 Adams Avenue, Scranton, Pa. At any station, curve, or switch at which it is designed to operate the mechanism is placed an auxiliary double-inclined track rail, near the main rail. On the under side of the locomotive is a vertical cylinder carrying a piston which is normally pressed downward by a spring, and the downwardly extending piston rod is engaged by a socket on a sliding rod carrying on its lower end a roller adapted to pass over the auxiliary rail. Connected with the lower end of the cylinder is a pipe from a reservoir of compressed air or any fluid under pressure, and the lifting of the piston by the action of the auxiliary rail on the roller admits pressure to the cylinder, from which an oppositely arranged outlet pipe in which is a check valve leads to a small reservoir. From the latter lead a number of pipes, one to a cylinder, with piston and mechanism by which the brakes are automatically applied, another to a mechanism connected with the throttle valve, to shut off steam from the engine, and another to a mechanism for operating the whistle. When the engineer desires to sound a signal, shut off the steam and apply the brakes, at places other than those thus provided for, he shuts off the pipe from the power reservoir to the vertical cylinder, and opens a valve connecting such pipe with the small reservoir, by which the several mechanisms are then simultaneously operated directly, and independently of the vertical cylinder, with its piston operated by the auxiliary



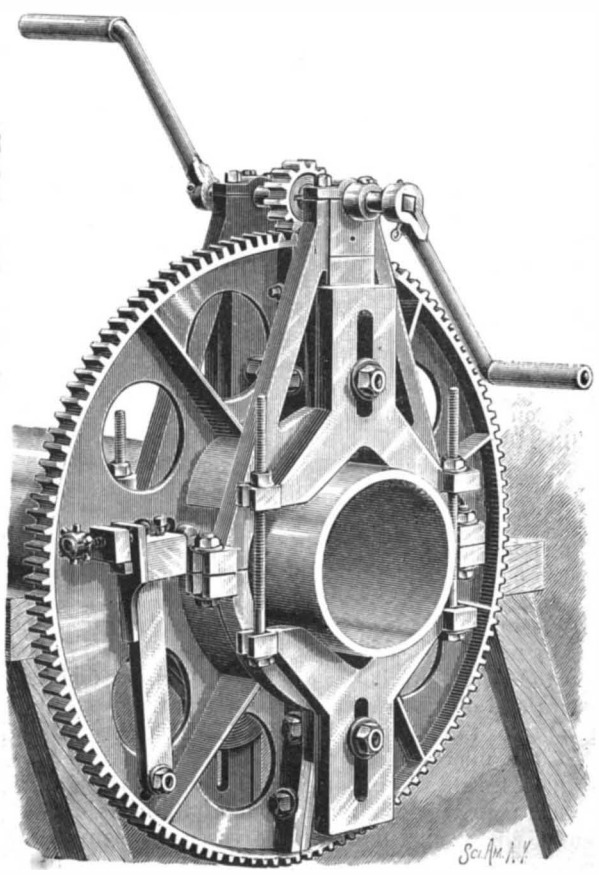
GROSS' LOCOMOTIVE ATTACHMENT.

track rail. To reset the apparatus it is only necessary to open an escape valve releasing the pressure in the small reservoir.

AN EFFICIENT PIPE CUTTING MACHINE.

The illustration shows a machine, patented by Mr. W. H. Garland, of Somerville, Mass., for cutting cast iron water and gas pipes of all sizes, from four to twelve inches in diameter. It has two side plates or frames, each having a circular hole to receive one end of the hub of a large toothed wheel composed of two semicircular parts, with flanges united by bolts. In the upper ends of the side frames are bearings for a shaft on which is a pinion engaging the teeth of the large wheel, the shaft having squared ends on which are suitable crank handles. On the side frames are upper and lower clamps, each having a vertical slot for the reception of a bolt to confine the clamp in proper position upon pipes of different sizes. The upper and lower clamps are connected by screw bolts passed through ears in the clamps, by which the latter may be brought into firm engagement with the pipe. Adjustably secured upon the rotating gear or large wheel is a Slate cutting-off tool, the arrangement being such that the cutting edge of the tool can be always brought into proper central line to cut freely into the pipe, while the feed is automatic, and the tool cuts very fast as it is made to travel about the pipe by the rotation of the gear wheel. This machine can be readily handled by two men and run by from one to four men when at work. The parts are interchangeable, and a particularly important feature of the improvement is that the parts may be separated to attach the machine to running pipe in the trench, whereby a great saving in time is effected, as compared with the methods now usually followed.

For further information relative to this invention address Mr. George A. Lloyd, East Cambridge, Mass.



GARLAND'S PIPE CUTTING MACHINE.

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New Electrical Research.

We publish this week one of the most valuable contributions to our knowledge of the properties and possibilities of alternating currents that has appeared for several years. The experiments of Mr. Nikola Tesla on alternating currents of almost transcendental frequency give a deep insight into one of the most extraordinary portions of electrical science. Mr. Tesla has worked with dynamos giving as high as 25,000 alternations per second, and consequently has within his grasp a class of phenomena that are only hinted at so long as experiments are confined to the frequencies in ordinary use. Not only is the work suggestive of practical results in the way of transforming by condensers, which with such frequencies becomes comparatively easy on account of the very small capacity required, but it is rich in suggestiveness as regards the relations between so-called electrical currents and the action that goes on in the dielectric. With a dynamo giving 20,000 or 25,000 alternations per second at an electromotive force of 500 volts, static effects became enormously enhanced. An immense amount of energy is distributed through the medium surrounding the machine, and, in fact, the experimenter may almost be said to be working in the dielectric of a condenser, of which the machine forms one surface and the surrounding walls the other. When incandescent lamps short-circuited by a bit of copper rod glow with intense brilliancy at some distance from the induction coil connected to the machine, Geissler tubes, unprovided with any terminals whatever, spring into brilliant radiance, and even an incandescent lamp grows hot when brought near the coil, the experimenter suddenly awakes from his dream of electrical energy as a thing carried along a wire into the almost appalling consciousness that the energy in the dielectric is really the only thing with which he has to do. We cannot, in the brief space available in these columns, give any adequate idea of the interest and beauty of the results that Mr. Tesla obtained in this novel line of work; the paper itself must be read and carefully re-read to appreciate the importance of the work. But even the striking experiments are of slight importance as compared with the theoretical results that are suggested by them. When displacement currents heretofore sought with almost negative results rise to a magnitude that heats the solid dielectric of the condenser almost to melting, one realizes with startling distinctness the truth of Maxwell's prophetic suggestions. Whatever may be our ultimate conception as to the nature of electricity, we are forced to the conclusion that the energy distributed through the dielectric is the all-important thing in electrical phenomena, and that the surface conditions that we know as electrification and current are comparatively subsidiary. Electrostatic induction and electromagnetic radiation seem simple, almost necessary, facts, when we can work in a medium surcharged by the tremendous electrical stresses that make themselves evident in such a machine as that with which Mr. Tesla experimented. Even if this research should lead to no results of immediate commercial importance, it at least marks an epoch in scientific investigation by casting a flood of light upon phenomena that until now have existed merely as residual effects sought in vain by the experimenter, or noticed only as the concomitants of other and apparently more important electrical actions.—*Electrical World.*

Mr. Tesla's paper will be found in this week's SUPPLEMENT, No. 792.

The Microbe of Rheumatism.

Dr. Bordas has given in *La Medecine Moderne* the results of some of his researches in acute articular rheumatism, which in his opinion tend to show that the cause of that disease is a pathogenic micro-organism specific in character. He reports that he has been able to isolate and cultivate a microbe which, when injected into the carotid artery of a rabbit, engendered an inflammation of the endocardium with vegetations upon the valves. He believes that acute articular rheumatism with its complications will be proved to be a disease produced by microbes analogous in their production, for example, to the *Micrococcus pyogenes*, and he is convinced that the organism investigated by him will be found by others to be the specific germ of that disease. The investigation was conducted under the supervision of M. Germain See, and will undoubtedly stimulate parallel researches in other laboratories. These, if confirmatory, will be important as an advance, not only in ætiological, but in therapeutical results.

It is only a year or two since the opprobrium was felt by nearly every thoughtful practitioner when the question arose how it was that quinine cured malarial fever; and now this reproach no longer rankles in the mind since the laboratory work of Laveran has shown that the micro-organism of malaria is destroyed by quinine in his test experiments; and thus the old answer of many "green rooms," that quinine is competent to check malarial fevers by reason of the profound impression it makes upon nerve centers, is done away with. The history of this reproach makes it possible that the alleged discovery of Bordas may in the future be the means of explaining away that other enigma—why it is that salicylic acid and the salicylates are able to antagonize the rheumatic enemy in so large a proportion of cases.—*N. Y. Medical Journal.*

Fish Manure.

Peruvian guano, which has so long enjoyed a well deserved reputation, is really nothing but a fish manure. We know that the sea birds, the guanäes, whose droppings give rise to the guano beds, live exclusively on fish. What we see produced in our pigeon cotes and poultry houses is produced on a vast scale on the western coast of South America and on the islands in the neighborhood. The innumerable sea birds which frequent these regions deposit their excreta, which are derived from a strong animal diet, and are therefore very rich in nitrogen and phosphoric acid. Agriculture in making use of Peruvian guano utilizes for the benefit of the continent a substance which originates in the sea.

The rich beds of Peruvian guano being almost exhausted, industry has undertaken to prepare guano by submitting the innumerable riches of the ocean, the enormous shoals of fish which frequent certain seas, to chemical and physical treatment, by means of which they are directly converted into a commercial fertilizer, comparable in all respects with Peruvian guano. The origin of both is the same—the sea; the difference is that the process of preparation has been altered. For the natural digestion of the fish by the birds, a kind of artificial digestion has been substituted, which is purely mechanical, and acts by isolating the oily parts of the fish and leaving a residue composed of flesh and offal which, after various treatments, gives the fish manure now so well known in all agricultural countries.

Fish exist in great abundance on certain coasts; enormous quantities are captured, for example, on the banks of Newfoundland, in the Polar seas, on the coasts of Norway, and even on the ocean coast of France. A large proportion of these fish is intended for nourishment; the cod, the herring, and the sardine are prepared for preservation; but they all leave waste, such as the head, which should be utilized. Often the whole object of the fishing is the manufacture of manure. In America the fish manure industry is in a very flourishing state; the SCIENTIFIC AMERICAN estimates that it supplies agriculturists with 17,000 tons of fish guano per annum. The fish used is the *menhaden*, which frequents the coasts of America from Cape Hatteras to East Point. Since the fishing only lasts from May to November, every possible mechanical assistance is employed to enable the greatest amount of work to be done in the least time.

While in France only damaged fish, such as cannot be used for consumption, is employed for this purpose, on the Atlantic coast of the United States a veritable fleet, made up of large steamers (some of which are of 500 tons burden), is devoted to the fishing, to supply the works at which the manufacture is carried on.

In order to save delay in discharging the vessels, at one of the largest American works, that of Mr. T. Church, of Tiverton, elevators similar to those used for grain are employed to clear out the fish from the hold.

The fish manure industry has also been very largely developed in Norway. The firm of T. Jensen & Co., of London, which has just carried off the highest prize for fish manure, oils, etc., offered at Vienna, occupies the first rank in this branch of commerce. It has established large works, which turn out annually a supply of 5,000 to 7,000 tons of fish guano, 2,000 to 4,000 tons of which are made from cod.

One of the largest works in the world devoted to the utilization of fish and their products is to be found at Brettesnoes (Loffoden Islands), on the northwest coast of Norway.

Brettesnoes, the name of which was scarcely known a few years ago, is now visited by all the tourists who go north to enjoy the spectacle of the midnight sun.

The town consists almost entirely of the establishments of Tensin & Co., whose offices are in London (109 Fenchurch Street). Its harbor, which is more than three miles in extent, can be entered at all times, owing to the great depth of water.

Messrs. Jensen also possess the island of Samoen, and a vast territory situated in the Finmach, whither the cod go after leaving Brettesnoes.

The steamer Louisa (1,000 tons) is continually employed in transporting guano, oil, and dried fish from the island to London, and returns freighted with coal and provisions. Three other small steamers are also in the service of the company.

The question naturally arises whether the supply of fish, the necessary material of the guano, is likely to become exhausted? In reply we quote the opinion of Prof. Huxley, as far as concerns Norway:

"Travelers who have visited the fisheries of the Loffoden Isles relate that the arrival of the shoals of fish in January and February is a most remarkable sight. The cod form what may be almost called a mountain, penetrating the sea to a depth of 36 to 55 meters; these enormous banks of fish are continually arising from the west and south throughout almost two months. Supposing that each fish is 1·25 meters long, and at a distance of say 0·75 centimeter from its neighbor, there would be about 120,000,000 fish per square mile.

"Now, the fisheries of the Loffoden Isles have never yielded more than 30,000,000 fish; the entire number taken in the whole of Norway certainly does not exceed 70,000,000. It appears, therefore, that a single shoal of cod is more than sufficient to supply the whole of the fisheries of Norway for an entire year."

Mr. Huxley points out that the cod preys upon the herring, so that the 120,000,000 cod forming the shoal one mile square, supposing that each fish devoured a herring per diem, would destroy 840,000,000 herrings a week.

These herrings, again, devour smaller fish, so that some idea may be got of the immeasurable riches of the northern seas at the period of the migration of the cod. Huxley concludes that this class of fish, cod, herring, sardines, mackerel, etc., *may be regarded as inexhaustible.*

The principal object of the Loffoden fisheries is the manufacture of cod liver oil.

As soon as the fish has been hoisted into the fishing boat, its head is cut off and the liver and roe extracted, the latter being used as bait for sardine. The only means of obtaining the oil fresh and sweet is to treat the liver immediately upon its removal from the fish. To effect this, and it is in this that Messrs. Jensen have shown their originality.

A special boat, which is itself a complete manufactory, follows the fishing boat in tow of a tug. As soon as the livers have been extracted, they are piled up in small casks on the Trafalgar (the ship just mentioned), and immediately placed in basins heated by steam to extract the oil.

The oil is then refined and purified before being sent into the market. It is free from all putrescible matter, is absolutely pure, and has a bearable taste.

The body of the cod is dried on the rocks to make "Klipfish," which is chiefly sold to Spain and the West Indies, or is salted and packed in casks.

The only portions of the unhappy codfish which are left are the head, backbone, entrails, and various waste portions. These residues, after undergoing several varieties of treatment, furnish the fish guano. Potassium salts are added in order to improve the character of the article. The mean composition of this product is as follows:

Brand.	Organic Ammonia.	Bone Phosphate.	Sulphate of Potassium.
C. P.	6½ to 7½	20 to 22	7 to 8
H. P.	7 " 9	10 " 12	7 " 8
G. P.	5 " 6	10 " 12	7 " 8

The great maritime fisheries of Norway produce annually:

Herring	121,069 cubic meters.
Cod	48,647 " "
Mackerel	7,146,000 " "

A good and efficacious fish guano must contain as little oil as possible, because the fatty matter prevents decomposition in the soil.

The oil is removed by mechanical pressure, and the pressed cakes obtained are again freed from oil by prolonged contact with boiling water. The residues are dried on plates or in retorts, and are then lightly roasted. This makes them brittle, and they are then ground and sieved.

This industry, the aim of which is to exploit the immense reserves of the sea for the benefit of agriculture, cannot be too much encouraged. It forms one way of restoring the mass of fertilizing material which is borne into the sea by the rivers. It is another instance of the fact that in nature nothing is created, nothing is lost, everything undergoes change.—*L'Engrais.*

Robert Mushet.

This well-known metallurgist, the inventor of Mushet's special steel, died on January 29, 1891, in the eightieth year of his age. He had received full recognition from the profession. In 1875 the British Iron and Steel Institute awarded him the Bessemer gold medal "in recognition of his great improvements in the manufacture of iron and steel." It was he who coped successfully with one of the early difficulties with the Bessemer process, suggesting the employment of manganese as a dephosphorizer. He also invented the process of adding spiegel iron to the metal in the converter at the expiration of the blow. This is one of the most important inventions in connection with the Bessemer steel process.

A GOOD rat story comes to us from Michigan. A straw held in the mouths of three rats drew the attention of citizens of Nashville to a strange sight. They were traveling along the road, three abreast, when it was discovered that the two outside rats were thus leading the center one, which was old and blind.

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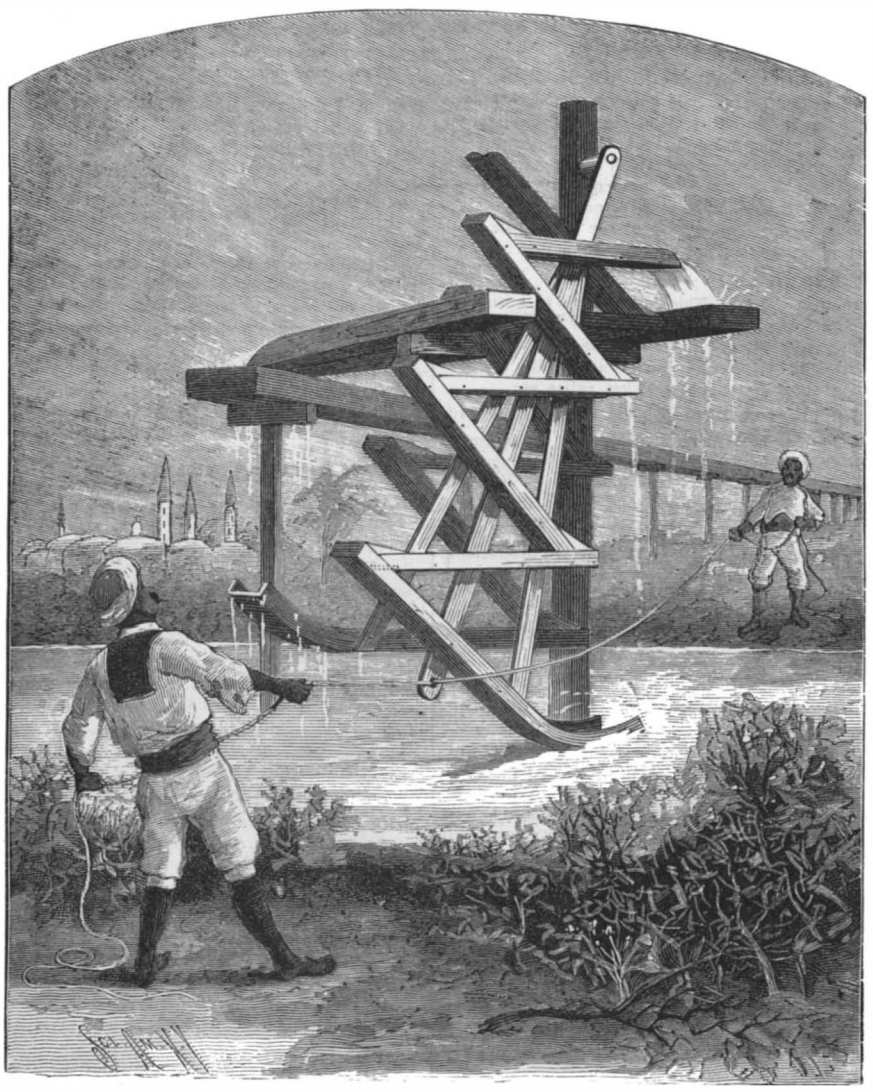
AN ANCIENT WATER ELEVATOR.

In Egypt and other countries where irrigation is practiced to a greater extent than elsewhere, the inventive mind has been alert for centuries, contriving devices of various kinds for elevating water. Some of these are so simple that they must have been obvious, while others show an amount of inventive genius worthy of our own century; in fact, as is well known, the fundamental principles of hydraulics were discovered ages since, and some of the early machines have never been materially changed or improved upon.

The Egyptian shadoof is a form of water elevator that has been in use from time immemorial, not only in Egypt, but almost all over the world. A device fully as simple as this, but not so old, is a gutter, which was made both single and double. It consisted of a trough pivoted at one end above the level of the water, the free end being alternately dipped in the water and raised, so as to cause it to discharge into a sluice leading away from the machine.

The pendulum water elevator shown in the engraving is a curious modification of the swinging gutter. A number of gutters arranged in two series are secured to opposite sides of a swinging frame, each series of gutters being arranged on a zigzag line, and the two series of gutters are oppositely arranged with respect to each other, so that while one end of the lower gutter dips in the water, the lower gutter of the other series discharges into the next gutter above, and a flap valve retains the water while the device is swung in the opposite direction. In this manner the water is advanced step by step at each oscillation, until it is finally discharged into the sluice, which carries it away for use. Each of the gutters, except the first of each series, is provided with a valve, which retains the water as it moves forward and upward.



PENDULUM WATER ELEVATOR.

Vaseline.

The lack of communications concerning vaseline and its manufacture leads us to imagine that a few remarks on this subject may be of interest to chemists and others.

In a previous number of the *Chem. Tech. Cent. Anzeiger* (1881, 42) two methods of manufacturing vaseline are given, one of which is specially prepared for official inspection, the other being entirely devoted to the excellent article made by L. Meyer, of St. Johann. No special points in the manufacture are brought out, and there is no space devoted to the theory of the manufacture, which is specially necessary for the explanation of this industry. It should also be noticed that several expressions in the descriptions above referred to appear more suited for a technical society than for a scientific journal.

That "sulphuric acid produces particles of carbon in oil" is, to say the least, not an expression which can be recommended as a model of scientific accuracy.

It is also difficult to understand why the last traces of the chemicals employed cannot be removed from the oils; we, in the mineral oil industry, remove the very last traces of reagents, and so do those vaseline manufacturers who use chemicals, and do not confine their purification to filtration through a charcoal filter.

It is now generally known that every vaseline manufacturer has his own secret process, and preserves it as closely as he can; any one not belonging to a works being thus compelled to make his own investigations.

Leaving unregarded the two methods previously mentioned, the following process has been devised, similar to that usually employed in the manufacture and purification of brown coal tar.

In commencing such an investigation, it is necessary to first of all definitely settle two points: "What is the quality of the new material?" and "What impurities are to be removed, and how can this best be done?" Knowing this, the outline of the process to be adopted is more than indicated. The nature of the raw material varies greatly. It usually consists chiefly of the residues of the so-called American petroleum, or it may be Russian oil, especially from Baku, under Galician oil and even bitumen itself, or natural asphalt, either in the solid state under this name, or of the consistency of tar, under the name of mine tar. It is, of course, obvious that no fixed method of preparation of the article termed vaseline can be given, and, in fact, the processes employed are very numerous.

The paraffins, as is well known, are hydrocarbons of the marsh gas series, and are classified into normal and iso paraffins, the corresponding members of which have the same percentage composition, but different structure. The American raw material—the viscid residue left on the distillation of the petroleum—is indispensable for the manufacture of yellow vaseline. The American petroleum, as obtained by boring, contains both classes of paraffins, of which the normal can only be brought to crystallization by the distillation of the petroleum, whereas the iso paraffin remains dissolved in the oil. According to the extent to which the oils are distilled off, a more or less liquid or pasty product is obtained—lubricating oil and vaseline. The distillation therefore effects the separation of crystallizing from amorphous paraffin, and only such raw materials as contain the latter, which therefore cannot pass or can only partially pass into the crystalline state, are fit for vaseline making.

Saxon brown coal tar, as is well known, deposits soft paraffin in scales in the cold, and contains no amorphous paraffin; these oils cannot, therefore, be used for the manufacture of lubricating oil and vaseline.

The case is quite different with American petroleum.

The residues from the distillation of American petroleum, which, as already mentioned, form a viscid or even soapy mass, are heated by steam and then well agitated with sulphuric acid to remove the resin which is still present.

At the close of this operation, after running off the resin by a tap, the excess of acid is neutralized with caustic soda or sodium carbonate solution, and the oil thoroughly washed with hot water until all the soda is removed. The material is then decolorized by animal charcoal, the liquid vaseline being stirred up with the charcoal by the aid of steam, and is then filtered hot. The only difficulty which has to be overcome in purifying the distillation residue lies in the correct proportion of soda solution to acid, which must be closely adhered to, since an excess of the former may emulsify the whole mass. The animal charcoal which is employed to decolorize the hot vaseline contains, as is well known, many inorganic salts, especially calcium phosphate and magnesium phosphate, as well as potassium chloride, sodium chloride, etc., so that it must be washed out with hot water, then with hydrochloric acid; then again with hot water, and finally dried; it thus acquires the property of retaining any caustic soda which has not been removed by washing.

The Russian oils are of special interest because of the "vaseline oil" which is made from them. After the light oils and normal paraffin have been removed from the oils, the heavy oils are purified by pressing, whirling, and decolorization, and then form the "paraffinum liquidum" of the pharmacopœia, which is also, probably, a solution of the iso paraffin in mineral oil.

Messrs. Hill, of Troppau, in Austrian-Schlesien, have for some time been producing a so-called "viscous natural vaseline." This product is of a darker color than the American quality, and is manufactured from so-called "blue oil," obtained in the distillation of Galician petroleum, directly after the light oil. It is an almost buttery mass, which deposits scales of paraffin in the cold, and is, therefore, also a mixture of heavy oils and solid paraffins. If, however, the distillation be stopped immediately after the lightest oils have come off, the residue in the retort, after treatment with sulphuric acid, etc., forms a homogeneous, fatty, lustrous mass—vaseline. This "viscous natural vaseline" is, therefore, the residue of the so-called "blue oil," which still contains amorphous paraffin, to which it owes its viscosity.

In making some experiments on the manufacture of vaseline, an oil was selected which had been obtained from the natural asphalt of Bentheim. The latter was submitted to distillation over a fire, and the oil fractionated according to its specific gravity. The oil of specific gravity 0·856 appeared the most suitable for the purpose. It was mixed with 4 per cent of sulphuric acid of 66 deg. B., and the resin drawn off after allowing the oil to stand for about twelve hours. It was then washed repeatedly with hot water until the latter gave no reaction with litmus paper. The clear oil was next thoroughly shaken with caustic soda solution, to remove creosote, the lather drawn off, and the oil again washed and treated while hot with the so-called decolorizing powder, the residues of the potassium ferrocyanide manufacture. The mass was then filtered and distilled until a heavy oil remained in the retort, which, after pouring out, became more viscid on standing, and was a kind of vaseline, since it deposited no crystalline matter even at 10 deg. Unfortunately, the light yellow mass became dark colored again when the oil was redistilled over the flame. However, no apparatus was at hand which would permit of the treatment of the strongly concentrated oils with reagents by the aid of steam, and it was, therefore, necessary to distill the oil after treatment. The vaseline obtained was yellowish brown, and had the well known bluish fluorescence, but was still rather fluid, differing in this respect from the American article, which it otherwise resembled.

The object was to prove that any distillation residue containing iso paraffin is more or less fitted for vaseline making, and this was successful. Whatever special method the individual manufacturers may possess of bringing the oils to the right consistency more rapidly and more simply, or of producing a light colored and odorless vaseline, the main outline of the process adopted cannot vary much, and must lead to the wished for end, provided that the crude material contains amorphous paraffin. Only such a material, which remains without crystalline deposit, even in the greatest cold, can produce the requisite viscosity of vaseline, and it will be found impossible to produce viscous vaseline from an oil which contains normal paraffin. The product will simply be a solution of crystalline paraffin in oils, without possessing the proper viscosity of vaseline, and will crystallize at a low temperature.—*Chem. Tech. Cent. Anzeiger*, *Chem. Tr. Jour.*

Electrical Utilization of Insects.

An electric apparatus supplies a strong light which attracts the insects and moths; a suction fan worked by the electric current draws them in when they approach the light, and carries them into a small mill, also worked by the electric current, where they are ground up and mixed with flour and thus converted into poultry food of excellent quality. This is said to be a Bavarian contrivance.

Failure in a Noted Case of Skin Grafting.

Mr. John O. Dickerson, of Chicago, on whom was engrafted 144 square inches of human skin, taken from 132 different individuals, in January last, died on February 24. The occasion arose from the removal of a cancer, and it was at first considered the operation was likely to be a success, the new skin having begun to attach itself over the wound, but the stomach of the patient gave out, the system having been overtaxed by numerous operations, and when nourishment failed the wound ceased to heal. Full particulars of the operation will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 788.

IN Switzerland a Sunday law has been enacted applying to all railroad, steamboat, and tramway companies and post offices. Working time must not be more than 12 hours a day, even on occasions of increased traffic. Engine and train men must have at least 10 hours unbroken rest, and other employes 9 hours. They must also have 52 days off yearly, and 17 of these must be Sundays. No reduction in wages is to be made for such rest days. All freight traffic on Sunday is prohibited, except live stock.

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RECENTLY PATENTED INVENTIONS.

Engineering.

SAFETY VALVE.—Erastus B. Kunkle, Fort Wayne, Ind. This is an improvement on a former patented invention of the same inventor, in which the valve body has a hood-shaped cap with a slide outlet, a cup-shaped valve being seated in the body, which contains a helical spring, the parts being so arranged that when the spring is once set, and the parts are put in position to lock a regulating screw in place, the parts cannot be tampered with without attracting the attention of those in charge.

ROTARY SNOW PLOW.—John W. Haughawout, Omaha, Neb. This plow has a wheel with a back plate from which extends a series of radial paddles, so as to form a central space on the back plate, where a cone is centrally secured with its base extending into the central space, reversible cutters being held on the front end of the paddles and the wheel being revolved by suitable means as the car holding the plow is pushed forward against the snow, whereby the snow is readily cut and discharged to either side of the track.

Railway Appliances.

RAIL JOINT. — John B. Walker, Corvallis, Oregon. This is an improvement in that class of rail joints in which a joint piece or girder is applied beneath the abutting ends of the rails and secured to them by claws or flanges that embrace their bases, thus forming a bridge and support for the rail ends and also holding them in due alignment, the joint piece or girder being so constructed as to be superior for its purpose.

DUMPING CAR.—John Lawson, Michigamme, Mich. This is a car adapted mainly for use in mining work, but also adapted for other purposes, and has a rigid flaring top, with suitable means for dumping the car, and for returning it to the point at which it is loaded, easily discharging every piece of material with which it is loaded, while it is operated in such manner that it cannot break loose, is very strong, and inexpensive in construction.

Electrical.

MAGNETIC ORE SEPARATOR.—Charles G. Buchanan, New York City. Combined with a hollow cylinder of magnetic material is a series of magnets within the cylinder connected to produce positive and negative poles in alternation around the circumference of the cylinder, while a commutator connected with the cylinder is adapted to change the direction of the current, and there is an ore-feeding hopper and stirrer to insure a uniform flow of ore to the separating cylinder.

Mechanical.

SOLDERING TOOL.—Edwin L. Barber, Henrietta, Texas. This is a tool which requires no furnace to heat it, having in itself a reservoir for gasoline or other light hydrocarbon and a burner and a valve for regulating the combustion of the gasoline as required for the proper heating of the tool.

DIE FOR MAKING BOLTS.—Thomas J. Bush, Lexington, Ky. This is an improvement on a former patented invention of the same inventor, relative to making interlocking bolts, the improvement consisting of a die or drop forging machine of peculiar construction to shape the locking end of the bolt.

SPINDLE DRIVER FOR SPINNING MACHINES.—Samuel James and Jeremiah K. Sanders, Lebanon, Mo. This invention covers a novel banding and tension mechanism whereby the spindles in a section of the machine will be simultaneously rotated in the same direction by a single band, the tension being automatically regulated, while a self-feeding oiler enables the apparatus to be run longer without stoppage than has heretofore been possible.

Agricultural.

POISON OR FERTILIZER DISTRIBUTER.—Charles K. Foster, Iola, Wis. This is a machine designed to drop the poison or fertilizer upon the hills only, and means are provided whereby the driver may cause the material to drop upon any hill out of the regular alignment, or cause it to be continuously spilled when the plants are high and spread from hill to hill, the invention covering a novel construction and combination of the several parts.

Miscellaneous.

WAISTBAND. — Frederick Spitz, New York City. This invention provides for the making of a waistband strip adapted to be wound in a roll, the proper lengths wanted for use being cut therefrom for use as desired, eyelets being formed at frequent intervals in the strip, and independent elastic loops near the eyelets.

GARMENT SUPPORTER.—Spurgeon C. Scantlebury, Eastport, Me. This invention provides a slotted plate, with studs and a key, forming a device especially adapted for use as a hose supporter, but also applicable with other garments, quickly and easily applied, not liable to slip, and that will not tear the garment.

RADIATOR.—Arthur H. Fowler, Buffalo, N. Y. This is a construction to facilitate the circulation of steam or hot water to heat buildings, the radiator having hollow sections forming air spaces, with side passageways and air ducts, and other novel features, designed to give a larger heating surface proportionate to the height of the radiator than usual, while reducing the cost of construction and fitting of the parts, insuring tight joints, free from leakage.

CASING TOBACCO. — John C. Frost, Statesville, N. C. This invention covers an apparatus with a casing cylinder having perforated coil pipes for spraying a solution upon the leaves, rolls for pressing the leaves as they pass out of the cylinder, devices for removing foreign matter and scraps before the tobacco is cased, with means for cooking the casing solution by steam heat, and always at a uniform temperature, all portions of the tobacco being treated alike.

ROOFING MATERIAL.—Joseph N. Hopper, Pawnee City, Neb. This is a new roofing material consisting of a layer of woven wire having its meshes filled with a plastic mass and with a backing of fabric saturated with a similar filling material and incorporated with the woven wire layer, whereby the whole is designed to be impervious to water, strong, flexible, easily repaired, and conveniently put up in rolls, the new article neither cracking from the winter's cold nor softening from the summer's heat.

IRONING BOARD. — Schooler C. Horn, Bladensburg, Ohio. This board has its sides and ends grooved, while a clamp with a top cross bar has its side and lower cross bars fitted to the edge groove of the board, to which a spring is secured having notches for engagement by the top cross bar of the clamp, the board being designed to facilitate properly shaping the bosom and neckband before the iron is applied.

DOOR CHECK.—John H. Minix, Eaton, Ohio. This device comprises an arm having a bearing to engage the floor, a handle by which the arm may be moved, and a spring to actuate the arm to adjust its bearing into and out of engagement with the floor, whereby the door may be held closed or partially open, as desired.

HOMINY FLAKES, ETC. — Jeremiah H. Little, Yellow Springs, Ohio. This invention covers an improved means of manufacturing hominy and corn flakes, while preserving their flavor, form and consistency, there being combined with the cooking vessel crushing rolls, a casing, a drying chamber, with shaking screens and a trough-like bottom, and means for forcing a hot air blast upward into the chamber.

VEHICLE SEAT. — James M. Johnson, Arneckeville, Texas. Side bars connected by a cross bar engage the top edges of the wagon body, and on the side bars are journaled shafts, each having two short cranks, to the outer ends of which springs are connected, the seat being supported upon opposite upper ends of the springs, the movement of one pair of springs tending to so regulate that of the other pair as to preserve the seat horizontally with an uneven load.

FOLDING CUP. — Hobart R. Haynes, Westminster, Mass. This cup is made of a series of spherical lunes hinged together at their ends and overlapping one another, forming a drinking cup of simple and durable construction which can be readily folded to take up but little room in a pocket, valise, etc.

SLATE. — Emma C. Hudson, Seattle, Washington. This invention provides an improved slate frame adapted to hold water and sponges for cleaning the slate, a tube to hold water, and with pockets for the sponges, being held in the slate frame.

PERSPIRATION POWDER. — Sarah G. Hull, Oklahoma, Oklahoma Ter. This is a deodorizing composition for application to the body, and is made of quinine and finely pulverized burnt alum, in specified proportions, the compound being generally harmless and designed not to interfere with healthy perspiration.

MAIL BAG FASTENING. — Stewart K. Davis, August F. Stockley and William I. Barnett, Buena Vista, Col. According to this invention the upper edges of the bag are formed into a roll, and sliding flexible sleeves encircle these rolled or doubled edges, a peculiar catch holding the sleeves together, making a fastening that is quickly operated, and designed to hold the sides of the bag so closely together that the smallest article cannot be abstracted.

PAPER BAG.—Charles W. Fishel and Frank E. Sweet, Carbondale, Col. Combined with a paper bag of ordinary form is an apron attached to one side, and a string with a loop at one end passed through holes in the apron, the bag being for the use of grocers and others, and the improvement saving wrapping twine and time in doing up packages.

HEAD COVERING.—Simon Tuch, New York City. This a new article of wear for ladies' and children's use, having a cap-like body covered with pliable stays, a portion of the covering projecting outward and adapted to be flared or bent to vary the appearance of the article, so that it may be readily changed into different shapes without unfolding or separating any of the parts.

BRACKET.—George R. Nafis, Brooklyn, N. Y. This invention consists of a sleeve fitted to turn on a pole and an arm having an inclined slot through which passes a pivot pin on the sleeve, the arm being adapted to engage with its inner edge the side of the pole or to turn on the pin to form a convenient bracket for use on clothes racks, flower stands, book cases, etc.

SIDEWALK. — Julius F. Jaquet, Milwaukee, Wis., and William McAuslan, Brooklyn, N. Y. Combined with a series of bracket stands are elongated and perforated sills, on which are located and interlocked tread pieces, in connection with sliding clamping blocks and keys, the whole designed to form a walk quickly put in place or taken up for repair, and made of either wood or terra cotta and metal.

PIER PROTECTOR. — Agnew Moore, Missoula, Montana. A vertical roller is journaled at the apex of the pier, and side rollers at the sides, a plate being arranged angularly between the front and side rollers at each side of the pier, the improvement being designed especially to protect bridge piers from drift wood, logs, boats, etc.

ADDING MACHINE. — Eri F. Jewett, Newtown, Ohio. Combined with a case having a slot and a series of tapes with numerals is a card having two series of numerals oppositely and alternately thereon, an apertured plate, and other novel features, by which numbers may be rapidly and accurately added or subtracted in a mechanical way, requiring little mental process.

FISH NET.—Larence A. Johnson, San Francisco, Cal. This is a net with an interior trap, and provided with a spar fitted with wheels or whirls near the ends, whereby the net may be readily drawn over the bottom of a body of water, and may be conveniently hoisted aboard a boat or vessel, while the fish may be readily taken from the net without interfering with the position of the trap.

FISHING REEL. — Elbert B. Porter, Penn Yan, N. Y. Combined with a driving crank and a driving spring is an intermediate planetary gearing by which the turning of the reel and the winding of the spring may be carried on simultaneously, the reel being detachable from the gearing, and a brake being provided for retarding the motion of the reel, and a drag to offer a slight resistance to its rotation and give an alarm.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

A NEW BUSINESS IN WALL STREET. Roderick H. Smith, 6 Wall Street, N. Y. Pp. 85.

The author of this work has developed a plan by which he believes some certainty can be attained in dealing in securities. By confining operations to dividend-paying stocks, buying on declines and selling on small advances, handling small lots and dividing the risks, a method is figured out that seems to show a reasonable chance of steady realization. To elucidate the scheme tabular statements of dealings are shown which represent actual accounts. The author certainly succeeds in picturing the advantages of Wall Street as a field for speculation, whether his plan will work or not, may be to a conservative mind at least an object of surmise. Mr. Smith, who is the author of "The Science of Business," "Smith Business Chart," etc., has certainly produced in "A New Business in Wall Street" a most interesting and attractive little work.

FIRST LESSONS IN METAL WORKING. By Alfred G. Compton. New York: John Wiley & Sons. 1890. Pp. vi, 170. Price $1.50.

In the present days of manual training in schools, a work emanating from the instructor in charge of the manual department of the College of the City of New York is of special value, and has an authoritative standing. Its illustrations and eminently practical directions fully carry out all anticipations.

SCIENTIFIC AMERICAN

BUILDING EDITION.

MARCH NUMBER.—(No. 65.)

TABLE OF CONTENTS.

1. Plate in colors showing the residence of P. H. Hodges, at Stratford, Conn. Perspective view, floor plans, etc. Cost complete $8,000.
2. Handsome colored plate of an elegant residence in Riverside Park, New York City. Floor plans, perspective elevation, etc. Cost $30,000.
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4. Handsome residence of Mr. F. Chamberlain, at Hartford, Conn. Francis H. Kimball, of New York City, architect. Floor plans, perspective elevation, etc. Cost $60,000 complete.
5. Illustrations of two attractive semi-detached houses erected for Mr. A. L. Pennock, at Philadelphia, Pa. Floor plans and perspective. Approximate cost $15,000 each. F. U. Beal, New York, architect.
6. Floor plans and photographic view of a residence at Edgecombe Court, Chicago, Ill. Estimated cost $5,400.
7. A pillar cottage erected for Mr. G. W. Childs, at Wayne, Pa. Cost $6,000 complete. Perspective and floor plans.
8. Handsome residence at Hartford, Conn., W. B. Tubbey, architect, New York. Cost $19,000 complete. Floor plans and perspective.
9. Two floor plans and photographic view of an attractive residence at Austin, Chicago, Ill. Estimated cost $7,000.
10. A very convenient and attractive suburban cottage of modern design, erected for Mr. E. W. Given, at Mont Rose, Orange, N. J. Cost $5,500 complete. Messrs. Rossiter & Wright, architects, New York. Floor plans and perspective.
11. Residence at Alexander Avenue, Buena Park, Chicago. Estimated cost $5,000 complete. Plans and photographic view.
12. Photographic perspective view of the residence of Mr. Frank Crowell, Minneapolis, Minn. F. E. Joralemon, architect.
13. Miscellaneous contents: Preserving smoke pipes from rust.—Door hanging, illustrated with 6 figures.—Safe construction of buildings, illustrated with 5 figures.—Improved blind slat planing machine, illustrated.—Seamless copper house boiler, illustrated.—Best quality of roofing tin plate.—Blower engines of the Galena.—An efficient sandpapering machine, illustrated.—The "Hero" spring hinge, illustrated.—The Duplex joist hanger.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(2870) C. A. W. asks: By what solvent can I obtain a clear solution of menthol up to 5 per cent? A. Dissolve in an essential oil, such as oil of cloves, and dilute with strong alcohol.

(2871) F. W. F. asks (1) for a good way to take the color from overalls without injuring them. A. If well dyed, it cannot be done. Chloride of lime might destroy the dye, but would tend to rot the cloth. If applied, it should be well washed out, and a dilute solution of sulphurous acid applied afterward. 2. For a good cement for holding glass together. A. Dammar varnish, or Canada balsam, or caseine cements; see query 2740.

(2872) M. D. asks: By what theory of physics is the extreme cold produced and explained resulting from anhydrous ammonia and sulphuric ether? A. The evaporation of the fluids requires energy, which is absorbed from surrounding bodies as heat energy, and which heat is rendered latent or caused to disappear.

(2873) R. H. asks how sulphur dioxide gas can be cheaply made. A. By heating concentrated sulphuric acid and sulphur or charcoal in a flask and conducting the evolved gas into water. Hyposulphite of soda can be treated with dilute sulphuric acid in an evolution flask and the gas can be collected as above.

(2874) H. A. asks: Can you give me ingredients for a solution in which to dip a small round lamp wick, to retard charring? A. Try phosphate of soda or borax dissolved in water.

(2875) W. A. asks: I want to know whether a piece of brass tubing one thirty-second thick, pushed over a coil, will weaken the current, or will the current pass through the brass the same as it does through the paper core the wire is wound on? A. Use the brass tube.

(2876) F. I. M. asks: 1. What causes the thinning out of negatives (dry plates) in the fixing bath after development? I have Cramer's plates No. 50, and made up the solutions just as described, but spoiled 8 plates already. The trays are clean, the developing and fixing solutions kept separate, every care is taken, nevertheless said result. A. The thinning of the negative plate is due to the dissolving out of the unacted upon bromide of silver in the film, either by light or the developer. If plates are under-exposed, they are likely to develop thin. If over-exposed, the same result is obtained and the picture flashes out quickly. If you have

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given the correct time, thinness is due to too short development. You need to keep the plate in the developer until you see signs of the image appearing through the back of the film. Probably your trouble has been in making instantaneous exposures with too weak a light or a slow lens stopped down. Both will make thin negatives. 2. Which are the best plates for instantaneous work? A. Cramer C, Seed 26, Stanley, Forbes and Carbutt plates are good. 3. Can you give me a good formula for a developing and fixing bath? A. The developing and fixing baths must be kept separate. An energetic developer is made by dissolving in warm

Water	40 oz.
Sulphite sodium c. p.	2 "
Eikonogen	1 "

To two ounces of the above add one drachm of following solution:

Water	3 oz.
Carbonate of potash	1 "

Begin by soaking the plate in the first solution a few minutes, then, should the plate refuse to develop, add the second. A fixing bath is made by dissolving 1 ounce of hyposulphite of soda in 6 ounces of water. 4. Do you know of any good book containing instructions in developing, fixing, printing, and what is the price? A. "The Amateur Photographer," by Ellerslie Wallace. Price $1.

(2877) G. L., alluding to an article in our SUPPLEMENT, No. 226, in which "black alder" is given as the popular name of *Rhamnus frangula*, asks if this is not an error, as "black alder" is the popular name of *Ilex verticillata*. A. No; it is not an error, in one sense. If the popular names of plants were subject to laws, the name "black alder" would, by the law of priority, belong to *Rhamnus frangula*, which, by the old herbalists, was called *Alnus nigra*, because, as Gerard observes, its "leaves be like those of the alder tree (the *Alnus glutinosa* of Europe), yet blacker." The name "alder" properly belongs to the species included under the generic name of *Alnus*, a Latin term cognate with the Teutonic, Scandinavian, and Sclavonic names of the common alder of Europe. The name "black alder" is properly applied in this country to *Alnus serrulata* and *A. incaua*, and improperly to *Nemopanthes Canadensis* and *Ilex verticillata*. To the last mentioned plant the name was applied by the early English colonists. The reason for the application is not obvious, since the plant is not an alder, resembles no species of alder, and is not black in any of its parts. The most conspicuous feature of the plant is its bright red berry-like drupes, which persist through the winter (as implied in the popular name "winterberry"), and which, one would suppose, would have recalled to the English mind the fruit of the common holly (*Ilex aquifolium*) of the old country, a plant generally related to our so-called "black alder." It must be remembered that the English names of plants given in medical works are not always popular, in the strict sense of the word, but are often merely translations of Latin names used by the older botanists, who were merely wont to classify plants rather by their external resemblances than by their botanical affinities.

(2878) T. H. asks (1) how to make a preparation for bleaching lard. A. One process is to heat the melted fat with sulphuric acid 1·3 to 1·45 sp. gr. 2. One for preserving meats (made with boracic acid). A. 92 parts pure glycerine are heated to 302° Fah., and 62 parts of finely pulverized boracic acid are added. Steam is evolved in considerable quantities. An entire day is needed for the preparation of 6 pounds. Or 100 parts common borax may be dried completely and mixed with 150 parts glycerine at the above temperature. They are about twenty times as powerful as salt.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the number therein given:

(2787) In reply to inquirer No. 2787, would say if his cider is colored with any iron substance, that is to say, if any nails are driven through the barrel into it, use fresh sweet milk, one quart, put in barrel and stirred up, and then filtered, will make it clear as if fresh made. Try it on small quantity; say take vinegar and whisky and add a few drops of tincture iron; it will turn black; then add your milk, and filter.—GEO. W. GULLICK.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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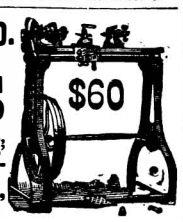

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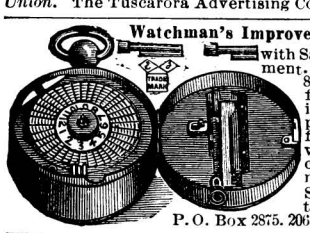

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FORTY-SIXTH ANNUAL REPORT

—OF THE—

NEW-YORK LIFE INSURANCE COMPANY

Office: Nos. 346 & 348 Broadway, New York.

JANUARY 1, 1891.

Amount of Net Assets, January 1, 1890 ..... **$101,027,322.46**
Less Contingent Sinking Fund (reduced value in securities, December 31) 568,525.11
$100,458,797.35

REVENUE ACCOUNT.

Premiums	$28,863,854.71	
Less deferred premiums, January 1, 1890	1,635,645.37	$27,228,209.34
Interest and rents, etc	5,371,235.38	
Less interest accrued January 1, 1890	441,344.64	4,929,890.74
		$32,158,100.08
		$132,616,897.43

DISBURSEMENT ACCOUNT.

Losses by death, and Endowments matured and discounted (including reversionary additions to same)		$7,078,272.48
Dividends (including mortuary dividends), annuities, and purchased insurances		6,201,271.54
Total Paid Policy Holders	$13,279,544.02	
Taxes and re-insurances		290,257.97
Commissions (including advanced and commuted commissions), brokerages, agency expenses, physicians' fees, etc		5,400,061.19
Office and law expenses, rentals, salaries, advertising, printing, etc		1,082,662.86
		$20,052,526.04
		$112,564,371.39

ASSETS.

Cash on deposit, on hand, and in transit	$6,348,924.46
United States Bonds and other bonds, stocks, and securities (market value, $67,250,984.74)	63,867,516.16
Real Estate	14,341,917.35
Bonds and Mortgages, first lien on real estate (buildings thereon insured for $15,000,000, and the policies assigned to the Company as additional collateral security)	19,446,083.13
Temporary Loans (market value of securities held as collateral, $5,391,511)	4,168,000.00
*Loans on existing policies (the Reserve on these policies, included in Liabilities, amounts to over $2,000,000)	431,108.71
*Quarterly and semi-annual premiums on existing policies, due subsequent to Jan. 1, '91	1,858,327.00
*Premiums on existing policies in course of transmission and collection. The Reserve on these policies, included in Liabilities, is estimated at $2,000,000)	1,431,828.15
Agency balances	195,812.91
Accrued Interest on investments, January 1, 1891	474,823.52
	$112,564,371.39
Market value of securities over cost value on Company's books	**3,383,438.58**

* A detailed schedule of these items will accompany the usual annual report filed with the Insurance Department of the State of New York.

TOTAL ASSETS, JANUARY 1, 1891, - - - - - - - - - - $115,947,809.97

Appropriated as follows:

Approved losses in course of payment	$613,040.54
Reported losses awaiting proof, etc	364,502.44
Matured endowments, due and unpaid (claims not presented)	39,389.77
Annuities due and unpaid (claims not presented)	22,901.33
Reserved for re-insurance on existing policies (Actuaries' table 4 per cent. interest)	99,954,304.00
Reserved for premiums paid in advance	54,660.53
	$101,049,359.11
Surplus, Company's Standard	**$14,898,450.86**
Consisting of	
Estimated contingent Tontine Surplus Fund	$8,670,539.50
Estimated General Surplus	6,227,911.36

From the undivided surplus, as above, the Board of Trustees have declared a Reversionary dividend to participating policies in proportion to their contribution to surplus, available on settlement of next annual premium.

GROWTH OF THE COMPANY DURING THE PAST DECADE.

New Insurance Issued.	Insurance in Force.	Assets.	Annual Income.
In the year 1880 .... $22,229,979	Jan. 1, 1881 .... $135,726,916	Jan. 1, 1881 .... $43,183,934	1880 .. $8,964,719
In the year 1885 68,521,452	Jan. 1, 1886 259,674,500	Jan. 1, 1886 66,864,321	1885 .. 16,121,172
In the year 1890 159,576,065	Jan. 1, 1891 .. 569,338,726	Jan. 1, 1891 115,947,810	1890 .. 32,158,100

Number of policies issued during the year, 45,754. New Insurance, $159,576,065.

Total number of policies in force January 1, 1891, 173,469. Amount at risk, $569,338,726.

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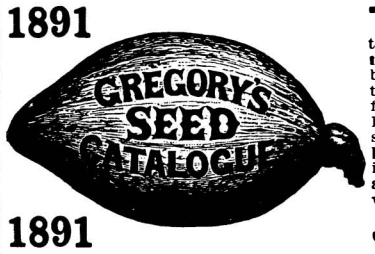
1891



1891

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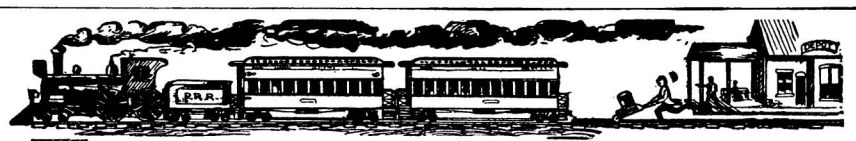

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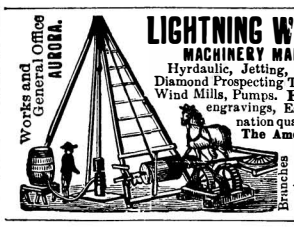

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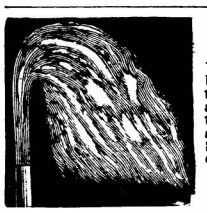

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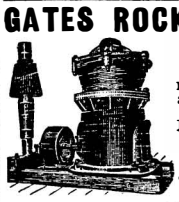

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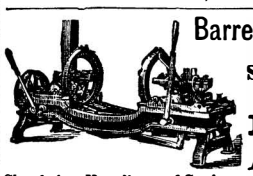

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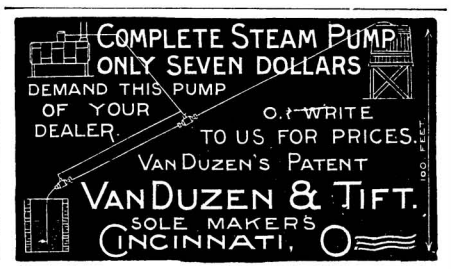

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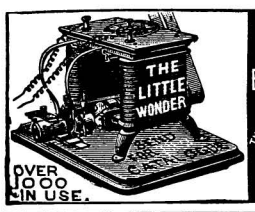

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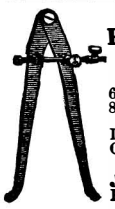

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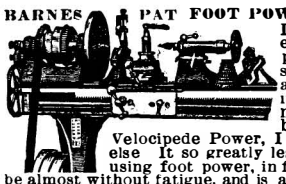

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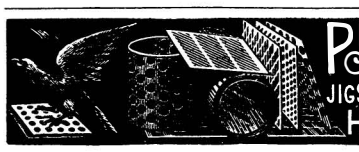

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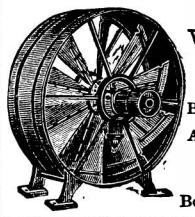

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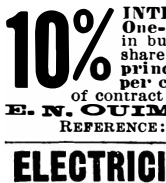

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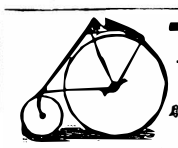

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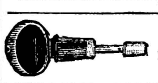

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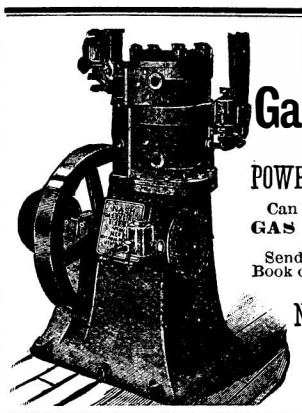

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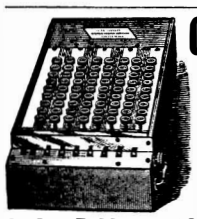

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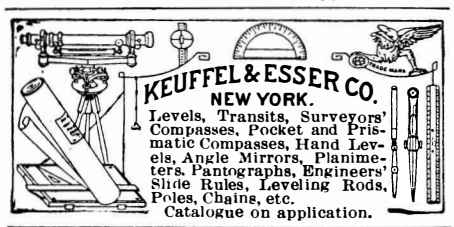

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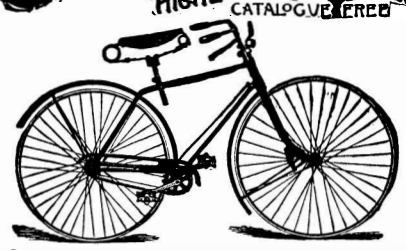

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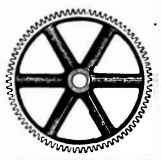

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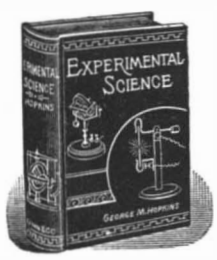

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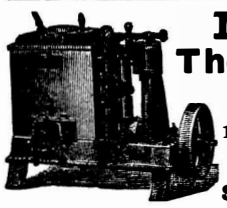

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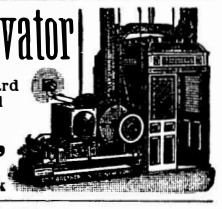

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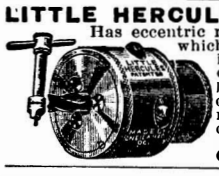

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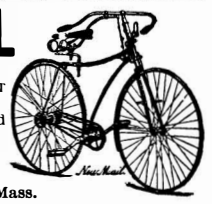

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